Chambers's Practical Concentric Arithmetics

By

A HEAD TEACHER

With Original Ideas and Wide Practical Experience

Edited by

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Book V

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Book V.

Exercise 1.—Extension of Previous Rules.

(1) A certain machine makes **3895** screws in a day. How many can it make in **319** days?

(2) There are **29** wards in a city, with an average of **6874** voters in each. How many voters are there in that city?

(3) Find the total wages earned by **16** labourers in **37** days, if each is paid **3**s. **6½**d. per day.

(4) A manufacturer produced **750** hats at a cost of **8**s. **6**d. each. He sold $\frac{1}{5}$ of them at **11**s. **9**d. each. What would be his total gain, if he sold the remainder for **£315**?

(5) I buy **250** oranges at **5** for 3d., and **320** at **4** for **2½**d. Find my gain if I sell the whole at **1**d. each.

(6) A fruit merchant sold **81276** bunches of bananas in a year. What was his weekly average?

(7) After dividing by **179**, a boy had a quotient of **647** and **87** over. What was the dividend?

(8) **916874** ÷ (*a*) **127**; (*b*) **239**; (*c*) **349**.

(9) An engine pumps **178** gallons of water per minute. How many days, &c., will it take to empty a reservoir containing **6388420** gallons, if the engine works day and night?

(10) The *Mauretania* travels at an average speed of **24** nautical miles per hour. How many nautical miles will she go in **4** dy. **18** hr.?

(11) If a nautical mile = **2027** yd., how many ordinary miles does she travel in that time?

(12) Snow weighs about **10** lb. per cubic foot. If the snow is **6** in. thick, how many lb. of snow are there on a roof **96** ft. long, each half of the roof measuring **15** ft. from top to bottom?

(13) Work, by as short a method as possible, $396 \times 2 \times 8 \times 500$.

(14) (*a*) 999×25; (*b*) 499×125; (*c*) 687×99; (*d*) $368 \times 4 \times 250$; (*e*) 365×101; (*f*) 258×104. (*Use short methods.*)

(15) Make up a sum about passengers on a tram-car, and work it.

Exercise 2.—Extension of Previous Rules.

(1) Find the cost of $84\frac{5}{8}$ tons of sugar at 12s. 7d. per cwt.

(2) A pump lifts 75 gallons of water every minute. If it works night and day, how many gallons will it lift in 3 days?

(3) Work in the shortest way: $285 \times 4 \times 2 \times 50$.

(4) £1, 18s. $6\frac{1}{2}$d. × (*a*) 47; (*b*) 82; (*c*) 95; (*d*) 67.

(5) £3, 16s. 7d. × (*a*) 38; (*b*) 76; (*c*) 114; (*d*) 86.

(6) £7, 13s. $9\frac{1}{2}$d. × (*a*) 29; (*b*) 46; (*c*) 85; (*d*) 99.

(7) Write down the answers to the following: $6\frac{1}{2}$ dozen lb. of rice at 4d. per lb.; 150 eggs at 1s. 6d. per score; 1 gross of spoons at $3\frac{1}{2}$d. each; 54 lb. of bacon at $10\frac{1}{2}$d. per lb.

(8) The distance between 2 towns is 3 m. 4 fur. If the circumference of a cart-wheel is 3 yd. 2 ft., how often will the wheel turn round in going the distance?

(9) £385, 17s. 6d. ÷ (*a*) 39; (*b*) 47; (*c*) 84; (*d*) 57.

(10) £436, 19s. 5d. ÷ (*a*) 35; (*b*) 87; (*c*) 72; (*d*) 94.

(11) £648, 17s. 8d. ÷ (*a*) 26; (*b*) 43; (*c*) 56; (*d*) 96.

(12) How many pieces of string each 6·5 dm. long can be cut from a piece 13 Dm. long?

(13) What are the total wages for a day of 9 masons at 9d. per hr., and 7 labourers at $7\frac{1}{2}$d. per hr., if they work $9\frac{1}{2}$ hr.?

(14) (*a*) £3·6 + £15·65 + £2·34 + £4·76;
(*b*) 5·05 tons + 6·8 tons + 4·37 tons + 6·48 tons;
(*c*) 3·75 yd. + ·85 yd. + 4·25 yd. + 2·8 yd.;
(*d*) 4·87 m. + 1·39 m. + 2·06 m. + 2·59 m.

(15) Take £3·45 from £5·63; take 2·85 tons from 6·57 tons; from 5·84 m. take 4·37 m.

(16) A milk-can just holds 8 gal. 2 qt. 1 pt. If it is filled twice daily, how much milk is put into it during the month of October? (*Include Sundays.*)

(17) A farmer got 33 tons 12 cwt. 3 qr. of hay from 26 acres of land. How much was that per acre on an average?

(18) A railway engine which consumed $\frac{3}{4}$ cwt. of coal per mile ran from London to Bradford, a distance of 171 m. How many tons, &c., were needed for the journey?

(19) If a litre is reckoned at $1\frac{3}{4}$ pt., how many bottles, each holding a litre, can be filled from a 28-gallon barrel?

(20) Make up a sum about a grocer buying lard, and work it.

Exercise 3.—Extension of Trade Accounts.

(1) At an auction 8000 lambs were sold at an average price of 17s. 6d. each. Find in two ways the amount got for them.

(2) A merchant bought 6500 yards of dress material at $10\frac{1}{2}$d. per yd. What did he pay for the lot?

(3) In one week a firm of spinners paid £30, 6s. 9d. for stamps for the insurance of their work-people. If they paid 3d. for each person, how many worked at their mills?

(4) Irish butter is £4, 16s. 8d. per cwt. What is the cost of 9 tons 14 cwt.?

(5) A coal merchant paid £410, 13s. 4d. for 560 tons of coal. What was the price per ton?

(6) A butter factor bought 6400 lb. of butter at 11d. per lb., and sold it at a profit of $\frac{1}{8}$d. per lb. What did he get for the whole?

(7) Bricks are 36s. 0d. per 1000. It required 270000 bricks to build a chimney. If the other costs were £387, 10s. 0d., how much did the chimney cost?

(8) The carriage of wool from London to Bradford is £2, 5s. 0d. per ton. How much is paid for the carriage of 500 bales, each weighing 18 cwt.?

(9) Pig-iron is £4, 5s. 0d. per ton. If £531, 5s. 0d. was paid for a supply of this material, how many tons were bought?

(10) A manufacturer sold 500 pieces of silk, each 64 yards long, at 1s. 3d. per yard. What was the value of the whole?

(11) Wire-netting is 9s. 6d. for 50 yards. What does it cost for netting to fence a piece of ground 3 chains 7 yd. long and 2 chains 8 yd. wide?

(12) A litre is $1\frac{3}{4}$ pints. How many gallons are there in 84 litres?

(13) A fruit merchant bought 4 boxes of oranges, each containing 480, at 15 oranges for 1s. 0d. He sold them at 1d. each. What profit did he make?

(14) A roll of flannelette was 56 yd. long. 5 night-dresses, each requiring 4·5 yd., and 3 chemises, each taking 2·75 yd., were cut off. How much was there still on the roll?

(15) Work this bill: 7 lb. of bacon at $10\frac{1}{2}$d. per lb.; $3\frac{1}{2}$ lb. of cheese at 11d. per lb.; 44 eggs at 8 for 1s. 0d.; $3\frac{1}{2}$ lb. of tea at 1s. 10d. per lb.; 2 st. of sugar at $2\frac{1}{2}$d. per lb.

(16) Make up a sum about a farmer, and work it.

Exercise 4.—Decimals.

(1) The rainfall for the first five days of August was: ·46 in., ·04 in., ·03 in., 1·26 in., and ·45 in. What was the total?

(2) On 4th August 1912 the rainfall at Blackpool was ·52 in., and at Bridlington ·13 in. What was the difference between the two?

(3) On 3rd August the barometer was 29·563 in.; on 4th August it was 29·374 in. How much had it fallen?

(4) Find x in the following:
- (*a*) £4·75 + £2·87 + £3·67 + £9·28 = x;
- (*b*) £6·074 + £3·842 + £4·673 + £9·318 = x;
- (*c*) 6·75 in. + 8·6 in. + 4·25 in. + 26·5 in. = x;
- (*d*) 9·36 in. + 8·942 in. + 6·387 in. + 9·008 in. = x.

(5) (*a*) £3·25 − £1·86; (*b*) £4·62 − £2·95; (*c*) £8·06 − £2·08;
(*d*) 6·432 m. − 5·827 m.; (*e*) 9·384 m. − 3·926 m.;
(*f*) 6·4212 m. − 2·875 m.; (*g*) 8·3205 m. − 2·674 m.

(6) Find x in the following:
- (*a*) £6·87 + £2·63 + £4·89 − £6·87 = x;
- (*b*) £3·72 + £8·94 + £5·87 − £3·86 = x;
- (*c*) £2·67 + £1·05 + £4·38 − £5·7 = x;
- (*d*) 6·025 m. + 8·007 m. + 3·6742 m. − 8·076 m. = x;
- (*e*) 72·356 l. + 8·729 l. + 1·07 l. − 12·639 l. = x;
- (*f*) 14·638 g. + 136·297 g. + 26·874 g. − 15·697 g. = x.

(7) A field is 48·62 metres long and 38·58 metres wide. What is the distance round it?

(8) A man had £3·875. He spent £1·75, and then £1·89. How much had he left?

(9) A boy spent ·365 of his money, then ·275 of it, and then ·185. How much was spent, and how much was left?

(10) (*a*) Write down the following as decimals, and (*b*) add them together: $\frac{73}{100}$, $\frac{274}{1000}$, $\frac{32}{10}$, $\frac{71}{1000}$, $\frac{288}{100}$.

(11) A piece of wire is 57·42 m. long. 19·36 m. are cut off, and then 18·67 m. are used. How much remains?

(12) Make up a sum about £1·75, and work it.

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(13) An empty coal train consisted of 85 wagons. The average weight of a wagon was 2 tons 14 cwt. 2 qr., and the engine weighed 10½ tons. What was the total weight?

(14) 3 miles of electric cable have to be laid along a road. When 3275 yd. are laid, how much is there still to be done?

Exercise 5.—Decimals—Multiplication.

In putting down the sum, always arrange the multiplier and the multiplicand so that the units figure (if there is one) of the multiplier shall come under the right-hand figure of the multiplicand.

Multiply first by the **left-hand figure** of the multiplier, and place the first figure of each partial product under the figure you are multiplying by. E.g.:

$5{\cdot}64 \times 3{\cdot}72$		$18{\cdot}6 \times {\cdot}47$
5·64		18·6
3·72		·47
16·92	= 3 times 5·64	7·44
3·948	= ·7 " 5·64 *	1·302
·1128	= ·02 " 5·64	8·742
20·9808	= 3·72 " 6·64	

* *Note.*—$\cdot 7 \times \cdot 04 = 28$ thousandths, $\cdot 7 \times \cdot 6 = 42$ hundredths, $\cdot 7 \times 5 = 35$ tenths.

(1) On squared paper show the answers to the following:
(*a*) 3·5 in. × 3; (*b*) 3·5 in. × ·3; (*c*) 4·6 × 4;
(*d*) 4·6 in. × ·4; (*e*) 5·3 in. × 4; (*f*) 5·3 × ·4.

(2) On squared paper find the answers to the following:
(*a*) ·6 in. × ·6; (*b*) ·8 in. × ·8; (*c*) ·8 in. × ·6; (*d*) ·7 in. × ·5;
(*e*) 1·6 in. × 1·6; (*f*) 2·4 in. × 2·4; (*g*) 3·6 in. × 3·6.

(3) On squared paper find the areas of oblongs with these dimensions: (*a*) 3·5 in. by 3·6 in.; (*b*) 2·7 in. by 2·6 in.; (*c*) 3·8 in. by 2·6 in.; (*d*) 4·3 in. by 3·4 in.; (*e*) 4·6 in. by 2·8 in.; (*f*) 5·6 in. by 2·7 in.

(4) $36{\cdot}4 \times 6{\cdot}34$; $45{\cdot}8 \times 4{\cdot}57$; $8{\cdot}95 \times 6{\cdot}06$.

(5) $6{\cdot}38 \times 27{\cdot}8$; $6{\cdot}48 \times 0{\cdot}39$; $6{\cdot}48 \times 3{\cdot}9$.

(6) $6{\cdot}48 \times 5{\cdot}46$; $7{\cdot}65 \times 8{\cdot}72$; $5{\cdot}38 \times 4{\cdot}03$.

(7) $47{\cdot}6 \times 8{\cdot}9$; $68{\cdot}05 \times 7{\cdot}8$; $47{\cdot}62 \times {\cdot}07$.

(8) $54{\cdot}57 \times 38{\cdot}5$; $6{\cdot}407 \times 3{\cdot}05$; $87{\cdot}02 \times 3{\cdot}84$.

(9) $61{\cdot}93 \times 1{\cdot}07$; $4{\cdot}612 \times {\cdot}78$; $43{\cdot}51 \times 1{\cdot}92$.

(10) What is the cost of 24·6 metres of cloth at 7·6 fr. per metre?

(11) What is the value of 36·6 tons of maize at 21·25 dollars per ton?

(12) How much is left out of 100 metres of wire after making 27 hoops, each taking 2·65 metres?

(13) Make up a sum about 3·75 American dollars.

(14) Telegraph-poles are 55 yards apart. How many are there between 2 villages which are 4 miles apart?

Exercise 6.—Decimals—Division.

(1) Before beginning division of decimals, always make the divisor into a whole number by multiplying by 10, or some power of 10, and alter the dividend correspondingly. Thus, in the example worked, the divisor 3·8 becomes 38, while the dividend 23·94 becomes 239·4.

(2) Always place the quotient over the dividend.

$$
\begin{array}{r}
23{\cdot}94 \div 3{\cdot}8 \\
6{\cdot}3 \\
38\overline{)239{\cdot}4} \\
\underline{228} \\
{\cdot}114 \\
\underline{114} \\
\ldots
\end{array}
$$

(1) Measure a strip of gummed paper **7·5** in. long; gum this into your exercise-book, and find how often another piece the same width, and **1·5** in. long, will measure it.

(2) Measure a strip **·64** dm. long, and find how often a strip the same width, and **·08** dm. long, will measure it.

(3) Draw an oblong **6·4** in. long and **2·4** in. wide. Show how many strips **·8** in. wide can be cut from it. Do this in two ways.

(4) From paper cut out a square, each side **1·6** dm. long. Show how many strips the same length, and each **4** cm. wide, can be cut from it.

(5) (*a*) **64·28 ÷ 8**; (*b*) **56·42 ÷ 7**; (*c*) **89·01 ÷ 9**;
(*d*) **367·452 ÷ 12**; (*e*) **986·82 ÷ 6**; (*f*) **763·25 ÷ 5**.

(6) Work the following as far as hundredths in the answer:
(*a*) **163·9 ÷ 9**; (*b*) **876·5 ÷ 8**; (*c*) **948·24 ÷ ·6**;
(*d*) **358·06 ÷ ·7**; (*e*) **426·29 ÷ 5**; (*f*) **367·84 ÷ 12**.

(7) Work the following as far as thousandths in the answer:
(*a*) **369·04 ÷ 6·4**; (*b*) **876·25 ÷ 3·8**; (*c*) **987·63 ÷ ·65**;
(*d*) **837·023 ÷ 1·26**; (*e*) **938·003 ÷ ·26**; (*f*) **986·102 ÷ ·067**.

(8) How often can **1·7** tons of coal be taken from a heap containing **680** tons?

(9) How many times can **3·6** in. be cut from **18** yd. of string?

(10) One bag of coals weighs **136·6** lb., and another **138·9** lb. How often can a coal-box holding **14·5** lb. be filled from both bags?

(11) Make up a sum about sharing **£9·26**, and work it.

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(12) Add together **£3·4**, **£1·75**, **£6·86**, and **£2·15**.

(13) Add together the sum and difference of **3·75** tons and **1·96** tons.

(14) What is the value of **375·6** tons of coal at **£1·2** per ton?

(15) Give in metres the value of each figure in **32·46** Km.

Exercise 7.—Drawing to Scale.

(1) A class-room is **24** ft. long and **22** ft. **6** in. wide. Write down a scale suitable for representing this. Draw the plan, and find the area.

(2) A school-yard is **65** yd. long and **45** yd. wide. Find a suitable scale; draw the plan, and find the cost of asphalting the yard at **2**s. **9**d. per sq. yd.

(3) Using a scale of **1** in. to a chain, draw the plan of a field **132** yd. long and **121** yd. wide.

(4) A square class-room is **22** ft. **6** in. wide and **12** ft. high. There is a door **7** ft. high and **3** ft. **6** in. wide at one side of the room. Draw a plan of the room, and find the area of the walls, leaving out the door.

(5) At the other side of this class-room there are three windows, each **7** ft. **6** in. high and **5** ft. wide. Draw a plan of what you think that wall is like, allowing **9** in. between every two windows.

(6) Make a sketch of the front of a table; put on it the dimensions, and draw the plan to a scale of **1** in. to **1** ft.

(7) Make a sketch of a picture in your home, and draw a plan of it to the scale of **2** in. to a foot.

(8) Make a sketch of the front of the teacher's desk, and draw a plan of it to the scale of **2** in. to a foot.

(9) Make a sketch of a garden with a circular flower-bed in the middle, and draw a plan of it on a suitable scale.

(10) Measure your own step; find how many of your steps measure the length and width of your street, and draw a plan of the street. Put a cross where you live.

(11) Make a sketch of the front of a cupboard; put on it the dimensions, and draw the plan to a scale of **1** in. to **1** ft.

(12) Make a sketch of your bedroom, putting in the door, window, and fireplace. Put the dimensions in the sketch, and draw a plan to the scale of **1** in. to a foot.

(13) To a scale of $\frac{1}{8}$ in. to a foot, draw a plan of the largest room in your school. Put in to scale two of the most useful pieces of furniture.

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(14) (**15·6** tons $\div$ **1·3**) + (**40·5** tons $\div$ **1·5**).

(15) Three trucks contain **10·2** tons, **9·8** tons, and **8·8** tons of coal. How many loads, each weighing **1·2** tons, can be taken out of the three trucks?

Exercise 8.—The Circle.

Learn.—(1) The Greek letter π (called *pi*) is used to express the ratio of the circumference of a circle to the diameter.

(2) $\frac{\text{Circumference}}{\text{diameter}} = \pi$, or $3\frac{1}{7}$, or 3·1416.

In working the following, let $\pi = 3\frac{1}{7}$:

(1) A circular pillar has a diameter of **14** in. Find the circumference.

(2) A boy's hoop is **28** in. across the widest part. Find how far it is round.

(3) The circumference of a glass shade is **3** ft. **8** in. Find the radius.

(4) The circumference of a gasometer is **88** feet. What is the distance across the middle?

(5) The wheel of a motor-car is **35** in. in diameter. How far does it travel in turning round **20** times?

(6) In breaking-in a horse a man uses a rope **14** ft. long. The horse goes round in a circle with the rope tight. How far does it travel in going round **30** times?

(7) A cricket roller covers $18\frac{6}{7}$ feet in one revolution. What is the radius of the roller?

(8) A circular cheese has a radius of **7** in. How far is it round?

(9) A door is $3\frac{1}{2}$ ft. wide. The hinge is fixed to a wall. How far does the door travel if it is opened right back to that wall and then shut again?

(10) The string of a sling is $3\frac{1}{2}$ ft. long. How far does the heavy end travel if it goes **3** times round?

(11) The circumference of a bowl is **11** ft. Find the diameter.

(12) In a park there is a circular flower-bed **33** ft. in circumference. What length of string will be required to reach from the centre to the edge?

(13) A mill boiler is $10\frac{1}{2}$ ft. in diameter. What is the circumference?

(14) The radius of a wheel is $1\frac{3}{4}$ ft. What is the circumference?

(15) Make up a sum about the diameter of a sugar-basin, and work it.

Set out each sum clearly; thus:

(1) $3x+5=23$
$\therefore\ 3x=23-5$
$\therefore\ 3x=18$
$\therefore\ x=6$

(2) $4x-3=2x+7$
$\therefore\ 4x-2x=7+3$
$\therefore\ 2x=10$
$\therefore\ x=5$

(1) Find the value of x in the following:
(a) $2x+4=36$; (b) $4x+5=45$; (c) $9x+7=88$;
(d) $6x+8=80$; (e) $12x+6=150$; (f) $7x+24=108$.

(2) Find the value of x in the following:
(a) $3x-7=32$; (b) $4x-12=44$; (c) $6x-18=48$;
(d) $7x-10=46$; (e) $9x-24=93$; (f) $5x-17=63$.

(3) Find x in the following:
(a) $\frac{x}{5}=4$; (b) $\frac{x}{3}=8$; (c) $\frac{x}{6}+3=7$;
(d) $\frac{x}{4}+5=17$; (e) $\frac{x}{5}+7=12$; (f) $\frac{x}{7}+6=15$;

(4) Find the value of x in the following:
(a) $3x+4=x+14$; (b) $2x+9=x+18$;
(c) $7x+12=x+48$; (d) $4x+16=3x+28$;
(e) $8x+15=5x+45$; (f) $6x+18=4x+28$;
(g) $5x+15=3x+47$; (h) $9x+17=5x+97$;
(i) $7x-13=2x+57$; (j) $6x-15=2x+69$.

(5) A bag holds x lb. of flour, and another holds 6 lb. In both bags there are 20 lb. What weight is there in the first bag?

(6) One of two numbers is x, and their sum is 25. What are the numbers?

(7) (a) What is the cost of n lb. of lard at m pence per lb.?
(b) How many marbles are needed to make x marbles into 50?
(c) x tons of coal cost £7. What is the price per ton?
(d) A boy had x marbles. He won 9, and he then had 40. How many had he at first?
(e) A farmer had x sheep. He bought 120, and he then had 360. How many had he at first?

(8) A number of girls get 4d. each, and there is 8d. left out of 6s. 0d. (a) Write down how many pence were given away; (b) find how many girls there were.

(9) Make up a sum about x shillings, and work it.

Exercise 10.—Square Measure and Calculation of Values.

(1) A room is 27 ft. long and 16 ft. wide. Find the cost of covering it with carpet at 7s. 6d. per square yd.

(2) The cinder-track round a football-field is 9 ft. wide. If the playing-field is 180 yd. long and 100 yd. wide, find the cost of making the track at 6d. per sq. yd.

(3) Flagstones are 3s. 6d. per sq. yd. What is the cost of flagstones to make a causeway 95 yd. long and 9 ft. wide?

(4) A room is 120 ft. long and 30 ft. wide. What does it cost to concrete the floor at 2s. 9d. per sq. yd.?

(5) The room in question (4) is boarded all round to a height of 3 ft. What is the cost of boards at 1s. 3d. per sq. yd.?

(6) A bowling-green 40 yd. square cost £60 to make. What was the price per sq. yd.?

(7) The *Yorkshire Post* is 26 in. long and 20 in. wide, and contains 12 pages. How many sq. yd., &c., are there of printed matter?

(8) Tiles are 6 in. square. How many are required to cover a corridor 30 yd. long and 8 ft. wide? What is the cost of the tiles at 3d. each?

(9) A tramway is laid for 1 mile 2 furlongs. A space 6 feet wide is dug out for the lines and the paving between them. What is the area in sq. yd. of the part dug out?

(10) Calico is 27 in. wide. What length would cover 9 sq. yd.?

(11) Match-board is 10d. per sq. yd. What is the cost of wood to make a partition 36 ft. long and 10 ft. high?

(12) A school-yard is 45 yd. 2 ft. long and 28 yd. 1 ft. wide. What does it cost to asphalt it at 4d. per sq. foot?

(13) A wall is 36 yd. long and 7 ft high. What was paid for making it at 4s. 6d. per sq. yd.?

(14) Make up a sum about covering the floor of your living-room with oilcloth, and work it.

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(15) A sack of oatmeal contains 240 lb., and costs £1, 10s. 0d. In a year a grocer sold 8 sacks at 2d. per lb. What profit did he make?

(16) Find the area of a floor 24·4 m. long and 18·6 m. wide.

(17) On a wagon there were 4 circular oil-casks. Each cask was 5 ft. 6 in. in circumference. How far would they reach if placed side by side in a straight line?

Exercise 11.—Least Common Multiple.

(1) Find the Least Common Multiple of:

(*a*) **2, 4, 6, 12**;	(*b*) **3, 6, 9, 12**;
(*c*) **4, 8, 12, 6**;	(*d*) **9, 4, 3, 6**;
(*e*) **10, 5, 3, 30**;	(*f*) **3, 21, 7, 2**;
(*g*) **4, 10, 5, 20**;	(*h*) **6, 4, 9, 18.**

(2) Find the least quantity of tea which can be made up into either **4**-oz., **10**-oz., **8**-oz., or **16**-oz. packets.

(3) What is the least number of tickets which can be arranged in either **3**, **5**, **15**, or **10** rows?

(4) Five bells begin to toll together at **12** o'clock. They ring at intervals of **12**, **9**, **16**, and **8** seconds. What is the earliest time at which they will again toll together?

(5) Find the smallest amount of money which can be paid either in threepences, sixpences, florins, or half-crowns.

(6) A teacher arranges his class in groups of **4**, **10**, **5**, and **12**, leaving **2** children over each time. What is the smallest number of children he must have?

(7) Find the least number into which all the denominators of the following fractions will exactly divide: $\frac{1}{4}$, $\frac{1}{12}$, $\frac{7}{8}$, $\frac{9}{16}$.

(8) I have a certain number of pennies which I can make into groups of **9**, **12**, **16**, or **24**, and have **3** over each time. What is the least number of pennies I must have?

(9) What is the least sum of money which can be paid exactly in either crowns or florins?

(10) Find the smallest sum of money which contains **9**d., **1**s. **3**d., **1**s. **6**d., and **2**s. **0**d. an exact number of times.

(11) What is the smallest size of barrel which can be measured exactly by either a **2**-gal., **3**-gal., **4**-gal., or **5**-gal. jar?

(12) What is the shortest distance which can be measured an exact number of times by each of **3** pieces of cord, measuring **4** ft., **12** ft., and **9** ft. respectively?

(13) Find the Least Common Multiple of **15**, **20**, **30**, and **12.**

(14) Find the least number into which the denominators of these fractions will all divide exactly: $\frac{3}{16}$, $\frac{5}{24}$, $\frac{4}{9}$, $\frac{5}{12}$.

(15) Find the smallest sum of money which can be paid in either half-crowns, half-sovereigns, or half-guineas.

(16) What is the smallest number that can be divided by **30**, **18**, or **36**, and leave **5** in each case?

Exercise 12.—Vulgar Fractions—Introduction.

(1) Draw an oblong **6** in. long and **1** in. wide. At one end colour $\frac{5}{8}$ blue, and at the other end colour $\frac{1}{4}$ red. Write down the value of the part uncoloured.

(2) Work this sum by drawing lines: $\frac{3}{8}$ ft. + $\frac{5}{12}$ ft. + $\frac{1}{4}$ ft. (*Prove that you are right by means of figures.*)

(3) Show in your own way that $\frac{2}{3}$ in. × 8 = $5\frac{1}{3}$ in.

(4) Give the value of each of these fractions in three other ways: $\frac{1}{2}$ in.; $\frac{3}{4}$ in.; $\frac{5}{8}$ in.; $\frac{5}{12}$ in.

(5) Show by means of paper strips that **4** times $\frac{1}{5}$ in. = $\frac{1}{5}$ of **4** in.

(6) Arrange these fractions in order of size, beginning with the least: (*a*) $\frac{3}{5}$ in., $\frac{3}{4}$ in., and $\frac{1}{2}$ in.; (*b*) $\frac{3}{4}$ in., $\frac{1}{6}$in., $\frac{5}{12}$ in.

(7) Work these sums by means of coloured crayons: (*a*) $\frac{1}{5}$ of $\frac{1}{4}$ ft.; (*b*) $\frac{3}{5}$ of $\frac{1}{4}$ ft.; (*c*) $\frac{1}{5}$ of $\frac{1}{6}$ ft.; (*d*) $\frac{4}{5}$ of $\frac{1}{6}$ ft.

(8) Find the least number which contains all the numbers in each of the following groups: (*a*) **3**, **5**, **10**, **15**; (*b*) **4**, **6**, **8**, **12**; (*c*) **2**, **6**, **9**, **4**; (*d*) **6**, **12**, **4**, **20**.

(9) Write down the number of fifths, eighths, and tenths in each of the following: **2**; **3**; **5**. (*Give your answers in vulgar fractions.*)

(10) Show, by drawing two oblongs, each **1** inch wide and 2 inches long, how to add $\frac{3}{5}$ and $\frac{3}{4}$.

(11) Work these sums by means of gummed paper: (*a*) $1\frac{1}{2}$ in. + $1\frac{3}{8}$ in. + $1\frac{3}{4}$ in.; (*b*) $1\frac{1}{3}$ in. + $2\frac{1}{4}$ in. + $1\frac{1}{6}$ in.

(12) Make oblongs **5** in. long and **4** in. wide, and show the value of: (*a*) $\frac{1}{5}$ of $\frac{3}{4}$; (*b*) $\frac{3}{5}$ of $\frac{3}{4}$; (*c*) $\frac{1}{4}$ of $\frac{2}{5}$; (*d*) $\frac{3}{4}$ of $\frac{2}{5}$.

(13) Draw oblongs **6** in. long and **1** inch wide, and show how often (*a*) **3** inches contains $\frac{1}{4}$ in.; (*b*) **4** in. contains $\frac{1}{4}$ in.; (*c*) **5** in. contains $\frac{5}{8}$ in.; (*d*) **3** inches contains $\frac{3}{4}$ in.

(14) Show how often $\frac{2}{3}$ in. is contained in **8** in.

(15) Make up a sum about $\frac{3}{5}$ in., $\frac{2}{3}$ in., and $\frac{3}{4}$ in., and work it.

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(16) Write as vulgar fractions: ·**5**, ·**8**, 1·**3**, 2·**6**, 3·**14**, 4·**36**, 2·**75**, 1·**25**.

(17) (*a*) $3x + 17 = 2x + 22$; (*b*) $\frac{3x}{4} + 3 = \frac{2x}{4} + 5$.

(18) A bale of wool is $3\frac{1}{2}$ ft. long and **2** ft. broad. What area will **50** bales cover?

(19) A sheet of paper is **3·7** dm. long and **2·4** dm. wide. What area would **100** such sheets cover?

Exercise 13.—Vulgar Fractions and their Meaning.

(1) Write each of these whole numbers in fractional form in six different ways: **2, 3, 4, 5, 6, 7.**

(2) What are the prime factors of **12, 14, 18, 24, 36, 39, 45, 99, 121, 132, 144**?

(3) Write down the least number into which each of the following groups of numbers will divide exactly:
(*a*) **2, 3, 4**; (*b*) **3, 6, 12**; (*c*) **2, 5, 6**; (*d*) **4, 8, 5**;
(*e*) **3, 5, 9**; (*f*) **3, 5, 7**; (*g*) **4, 7, 12**; (*h*) **3, 2, 11.**

(4) Write these fractions in their simplest form: $\frac{16}{24}$, $\frac{18}{27}$, $\frac{9}{12}$, $\frac{14}{36}$, $\frac{14}{49}$, $\frac{15}{45}$, $\frac{21}{24}$, $\frac{40}{42}$.

(5) Write down the prime factors of these numbers: **11, 15, 21, 28, 35, 44, 56, 72, 84, 96, 110.**

(6) Express the following as fractions without whole numbers: $3\frac{1}{2}$, $2\frac{1}{5}$, $3\frac{3}{8}$, $4\frac{5}{7}$, $5\frac{6}{9}$, $3\frac{1}{12}$, $4\frac{3}{10}$, $6\frac{3}{11}$, $4\frac{5}{12}$.

(7) Give as mixed numbers: $\frac{15}{2}$, $\frac{17}{2}$, $\frac{12}{4}$, $\frac{28}{6}$, $\frac{18}{11}$, $\frac{19}{5}$, $\frac{27}{12}$.

(8) Draw oblongs to show:
(*a*) $\frac{3}{4}=\frac{9}{12}$; (*b*) $\frac{2}{3}=\frac{10}{15}$; (*c*) $\frac{3}{5}=\frac{15}{25}$; (*d*) $\frac{5}{6}=\frac{20}{24}$;
(*e*) $\frac{4}{5}=\frac{16}{20}$; (*f*) $\frac{8}{16}=\frac{1}{2}$; (*g*) $\frac{12}{20}=\frac{3}{5}$; (*h*) $\frac{9}{15}=\frac{3}{5}$.

(9) Find the value of x in the following:
(*a*) $\frac{2}{3}=\frac{x}{18}$; (*b*) $\frac{3}{4}=\frac{x}{16}$; (*c*) $\frac{5}{7}=\frac{x}{21}$; (*d*) $\frac{4}{9}=\frac{16}{x}$;
(*e*) $\frac{x}{5}=\frac{18}{30}$; (*f*) $\frac{5}{x}=\frac{20}{28}$; (*g*) $\frac{3}{7}=\frac{9}{x}$; (*h*) $\frac{4}{7}=\frac{x}{35}$.

(10) Write down these fractions so that each group has a common name:
(*a*) $\frac{1}{2}$, $\frac{3}{5}$, $\frac{3}{4}$; (*b*) $\frac{2}{3}$, $\frac{5}{8}$, $\frac{5}{6}$; (*c*) $\frac{4}{5}$, $\frac{3}{7}$, $\frac{1}{2}$;
(*d*) $\frac{2}{7}$, $\frac{1}{3}$, $\frac{4}{9}$; (*e*) $\frac{5}{6}$, $\frac{7}{12}$, $\frac{3}{4}$; (*f*) $\frac{4}{5}$, $\frac{3}{8}$, $\frac{1}{4}$.

(11) In each of the following pairs of fractions, write down which is the greater:
(*a*) $\frac{1}{3}$ or $\frac{3}{7}$; (*b*) $\frac{3}{5}$ or $\frac{5}{8}$; (*c*) $\frac{5}{6}$ or $\frac{7}{10}$; (*d*) $\frac{4}{5}$ or $\frac{7}{8}$;
(*e*) $\frac{3}{4}$ or $\frac{4}{5}$; (*f*) $\frac{5}{7}$ or $\frac{3}{8}$; (*g*) $\frac{4}{9}$ or $\frac{5}{12}$; (*h*) $\frac{7}{12}$ or $\frac{8}{15}$.

(12) Write these fractions in their lowest terms:
$\frac{12}{16}$, $\frac{20}{24}$, $\frac{14}{35}$, $\frac{21}{84}$, $\frac{9}{36}$, $\frac{4}{24}$, $\frac{26}{39}$, $\frac{44}{121}$, $\frac{18}{72}$, $\frac{34}{84}$, $\frac{25}{90}$.

(13) Write the following groups of fractions, using the same name for all the members of the same group:
(*a*) $1\frac{1}{2}$, $1\frac{3}{8}$, $2\frac{5}{12}$; (*b*) $3\frac{1}{4}$, $1\frac{4}{5}$, $1\frac{7}{10}$;
(*c*) $3\frac{1}{5}$, $3\frac{3}{8}$, $1\frac{3}{4}$; (*d*) $4\frac{1}{3}$, $1\frac{5}{6}$, $1\frac{3}{4}$.

(14) What is the least sum of money which can be paid in either half-sovereigns, crowns, florins, or sixpences?

Exercise 14.—Addition and Subtraction of Fractions.

(1) Work these sums (i.) with your ruler, and (ii.) by figures only:
(*a*) $\frac{3}{4}'' + \frac{1}{2}'' + \frac{1}{8}''$; (*b*) $\frac{3}{5}'' + \frac{7}{10}'' + \frac{1}{2}''$;
(*c*) $\frac{5}{12}'' + \frac{2}{3}'' + \frac{1}{4}''$; (*d*) $1\frac{1}{2}'' + 1\frac{3}{4}'' + 1\frac{3}{16}''$;
(*e*) $1\frac{3}{8}'' + 2\frac{3}{4}'' + 1\frac{7}{16}''$; (*f*) $\frac{5}{8}'' + \frac{5}{12}'' + 1\frac{1}{2}''$.

(2) Work these with coloured strips or by coloured oblongs:
(*a*) $2\frac{1}{2}'' + 1\frac{3}{10}'' + 1\frac{2}{5}''$; (*b*) $1\frac{5}{8}'' + 1\frac{3}{4}'' + 2\frac{1}{4}''$;
(*c*) $2\frac{3}{8}'' + 1\frac{5}{16}'' + 1\frac{1}{2}''$; (*d*) $1\frac{1}{3}'' + 2\frac{3}{4}'' + 1\frac{7}{12}''$;
(*e*) $2\frac{11}{12}'' + 1\frac{1}{4}'' + 1\frac{1}{2}''$; (*f*) $1\frac{7}{8}'' + 2\frac{1}{4}'' + 1\frac{1}{16}''$.

(3) (*a*) $\frac{3}{7}'' + \frac{1}{3}'' + \frac{1}{6}''$; (*b*) $\frac{2}{5}'' + \frac{3}{4}'' + \frac{7}{8}''$;
(*c*) $\frac{5}{6}'' + \frac{1}{4}'' + \frac{5}{9}''$; (*d*) $\frac{1}{12}'' + \frac{4}{5}'' + \frac{1}{10}''$.

(4) (*a*) $\frac{5}{6}'' + \frac{4}{9}'' + \frac{5}{12}''$; (*b*) $\frac{3}{7}'' + \frac{4}{5}'' + \frac{1}{2}''$;
(*c*) $\frac{3}{8}'' + \frac{3}{10}'' + \frac{5}{12}''$; (*d*) $\frac{2}{3}'' + \frac{4}{5}'' + \frac{3}{4}''$.

(5) (*a*) $1\frac{1}{2}'' + 2\frac{1}{9}'' + 1\frac{1}{4}''$; (*b*) $1\frac{1}{3}'' + 2\frac{5}{7}'' + 2\frac{3}{4}''$;
(*c*) $3\frac{5}{6}'' + 1\frac{3}{7}'' + 2\frac{1}{2}''$; (*d*) $4\frac{2}{3}'' + 2\frac{5}{8}'' + 3\frac{7}{12}''$.

(6) $2\frac{1}{3} + 3\frac{2}{5} + 1\frac{1}{3}$. (9) $1\frac{3}{5} + 2\frac{1}{7} + 1\frac{1}{2}$. (12) $3\frac{1}{4} + 2\frac{2}{5} + 3\frac{1}{3}$.

(7) $3\frac{1}{4} + 1\frac{2}{3} + 1\frac{7}{8}$. (10) $2\frac{5}{12} + 3\frac{1}{9} + 3\frac{1}{8}$. (13) $1\frac{4}{7} + 2\frac{1}{6} + 1\frac{1}{2}$.

(8) $2\frac{5}{12} + 2\frac{4}{9} + 1\frac{5}{6}$. (11) $3\frac{1}{6} + 2\frac{1}{3} + 1\frac{4}{5}$. (14) $3\frac{1}{8} + 1\frac{1}{4} + 2\frac{3}{10}$.

(15) Work the following sums, using two colours of crayons:
(*a*) $\frac{4}{6}'' - \frac{2}{3}''$; (*b*) $\frac{9}{10}'' - \frac{3}{5}''$; (*c*) $\frac{3}{4}'' - \frac{5}{12}''$; (*d*) $\frac{3}{4}'' - \frac{5}{16}''$;
(*e*) $\frac{4}{10}'' - \frac{2}{5}''$; (*f*) $\frac{5}{12}'' - \frac{1}{3}''$; (*g*) $\frac{4}{5}'' - \frac{7}{10}''$; (*h*) $\frac{5}{8}'' - \frac{5}{16}''$.

(16) (*a*) $1\frac{3}{4} - 1\frac{1}{16}$; (*b*) $3\frac{1}{2} - 2\frac{3}{8}$; (*c*) $4\frac{3}{5} - 1\frac{3}{10}$; (*d*) $\frac{3}{14} - \frac{4}{21}$;
(*e*) $2\frac{1}{5} - \frac{3}{50}$; (*f*) $4\frac{2}{7} - 1\frac{4}{21}$; (*g*) $4\frac{1}{2} - \frac{3}{16}$; (*h*) $3\frac{1}{4} - \frac{7}{20}$.

(17) (*a*) $(1\frac{1}{4} + 2\frac{1}{8}) - 1\frac{1}{16}$; (*b*) $(2\frac{3}{10} + 1\frac{1}{20}) - 1\frac{9}{100}$; (*c*) $(5\frac{1}{2} + 2\frac{3}{10}) + \frac{17}{100}$.

(18) (*a*) $(2\frac{3}{14} + 1\frac{1}{2}) - 1\frac{5}{21}$; (*b*) $(2\frac{1}{3} + 1\frac{3}{12}) - 1\frac{4}{9}$; (*c*) $(4\frac{3}{8} + 1\frac{4}{5}) - 1\frac{3}{4}$.

(19) (*a*) $(4\frac{1}{7} + 1\frac{5}{6}) - 1\frac{1}{3}$; (*b*) $(2\frac{1}{2} + 1\frac{1}{4}) - 1\frac{3}{16}$; (*c*) $(1\frac{3}{8} + 2\frac{3}{16}) - 1\frac{5}{16}$.

(20) (*a*) $(2\frac{3}{4} + 1\frac{5}{12}) - 1\frac{3}{16}$; (*b*) $(1\frac{2}{3} + 3\frac{3}{8}) - 1\frac{5}{12}$; (*c*) $(3\frac{1}{7} + 1\frac{1}{3}) - 1\frac{3}{14}$.

(21) $\frac{3}{8}$ inch is cut off from $1\frac{5}{16}$ inches. How much is left?

(22) What must be added to the sum of $3\frac{1}{12}''$, $4\frac{1}{16}''$, and $3\frac{3}{8}''$ to make **1** foot?

(23) $\frac{3}{8}$ of a pole is in the ground, $\frac{5}{16}$ is painted white, and the rest is painted blue. What part of the pole is blue?

(24) Make up a sum about some part of **1** lb., and work it.

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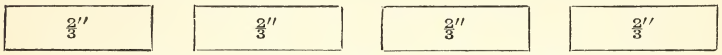
(25) The weights of **4** boys are **31·25** Kg., **29·7** Kg., **28·35** Kg., and **30·38** Kg. What is their total weight?

(26) In a year an Irish family used **84·8** lb. of oatmeal at **1·75**d. per lb. What was spent on this food?

Exercise 15.—Multiplication of Fractions.

(1) By drawing lines show: (*a*) $\frac{1}{2}$ of $\frac{3}{4}$ in.; (*b*) $\frac{1}{3}$ of $\frac{3}{4}$ in.; (*c*) $\frac{1}{4}$ of $\frac{3}{4}$ in.; (*d*) $\frac{1}{5}$ of $\frac{3}{4}$ in.; (*e*) $\frac{1}{6}$ of $\frac{3}{4}$ in. Write down the answers, and say what you notice about them all.



$\therefore$ $\frac{2}{3}''$ taken **4** times (i.e. $\frac{2}{3}'' + \frac{2}{3}'' + \frac{2}{3}'' + \frac{2}{3}'') = \frac{8}{3}'' = 2\frac{2}{3}''$.

(2) By means of oblongs, as shown above, work the following:
(*a*) $\frac{2}{3}'' \times 4$; (*b*) $\frac{3}{4}'' \times 5$; (*c*) $\frac{5}{6}'' \times 6$; (*d*) $\frac{4}{5}'' \times 7$;
(*e*) $\frac{3}{7}'' \times 5$; (*f*) $\frac{7}{10}'' \times 6$; (*g*) $\frac{5}{8}'' \times 5$; (*h*) $\frac{3}{5}'' \times 6$.

(3) Draw a line $\frac{5}{8}''$ long, and find the length of **2**, **3**, **4**, **5**, **6**, **7**, and **8** such lines.

(4) Draw a line $1\frac{3}{4}''$ long, and find the length of **2**, **3**, **4**, **5**, and **6** such lines.

(5) Draw a line $1\frac{3}{8}$ inches long, and find lengths **3** times, **4** times, and **5** times this.

(6) A board is $2\frac{5}{12}''$ broad. Find the breadth of **3** such boards; of **5** such boards; of **6** such boards.

(7) Draw an oblong **3**″ long and **2**″ wide. On this show that $\frac{1}{2}$ of $\frac{2}{3} = \frac{2}{6}$. Write down how the **2** and **6** are obtained.

(8) From an oblong the same size as in question (7) show that $\frac{1}{2}$ of $\frac{3}{4} = \frac{3}{8}$. Write down how the **3** and **8** are obtained.

(9) Draw an oblong **6**″ by **2**″. Find $\frac{5}{8}$ of it, and then show what $\frac{2}{3}$ of $\frac{5}{8}$ is equal to.

(10) (*a*) $\frac{4}{5} \times \frac{1}{3}$; (*b*) $\frac{3}{7} \times \frac{2}{5}$; (*c*) $\frac{5}{6} \times \frac{3}{4}$; (*d*) $\frac{4}{9} \times \frac{5}{6}$; (*e*) $\frac{3}{5} \times \frac{2}{7}$.

(11) (*a*) $1\frac{1}{2} \times \frac{4}{5}$; (*b*) $1\frac{2}{3} \times \frac{4}{7}$; (*c*) $1\frac{3}{8} \times \frac{3}{5}$; (*d*) $1\frac{1}{4} \times \frac{5}{6}$; (*e*) $2\frac{1}{3} \times \frac{3}{8}$.

(12) (*a*) $1\frac{3}{4} \times 1\frac{4}{5}$; (*b*) $1\frac{3}{7} \times \frac{4}{9}$; (*c*) $2\frac{3}{5} \times 1\frac{2}{5}$; (*d*) $3\frac{1}{4} \times 2\frac{3}{7}$; (*e*) $4\frac{1}{3} \times 1\frac{2}{7}$.

(13) A knot is nearly $1\frac{1}{7}$ m. per hour. If a boat goes $5\frac{3}{4}$ knots, how many miles is that per hour?

(14) Find: (*a*) $1\frac{1}{4}$ of $2\frac{1}{3}$ of $3\frac{1}{2}$; (*b*) $2\frac{3}{4}$ of $3\frac{2}{5}$ of $1\frac{3}{4}$;
(*c*) $2\frac{2}{3}$ of $1\frac{3}{4}$ of $1\frac{2}{7}$; (*d*) $3\frac{3}{8}$ of $1\frac{4}{9}$ of $2\frac{1}{7}$.

(15) What is the cost of $\frac{5}{6}$ of $7\frac{1}{5}$ yd. of cloth at $5\frac{3}{8}$s. per yard?

(16) Make up a sum about $\frac{3}{8}$ ton of coal, and work it.

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(17) A goods engine went at the rate of **15·6** miles per hr. In a week it went **873·6** miles. How many hr. did it work?

(18) Work the following bill: **18** st. of flour at **1**s. **8**d. per stone; **11** lb. of butter at **1**s. **1**d. per lb.; **6** lb. of tea at **2**s. **8**d. per lb.; **9** lb. of lard at $8\frac{1}{2}$d. per lb.

Exercise 16.—Division of Fractions.

(1) Draw a line 6″ long. Find $\frac{1}{3}$ of it, and then work the following sums: $\frac{1}{3} \div 2$; $\frac{1}{3} \div 3$; $\frac{1}{3} \div 4$; $\frac{1}{3} \div 5$; $\frac{1}{3} \div 6$.

(2) Work the following sums by drawing oblongs on squared paper: (*a*) $\frac{2}{3} \div 3$; (*b*) $\frac{3}{4} \div 2$; (*c*) $\frac{1}{2} \div 5$; (*d*) $\frac{5}{6} \div 3$; (*e*) $\frac{4}{5} \div 3$.

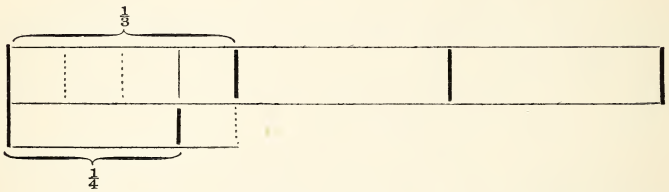
(3) Find how often 2, 3, 5, 6, and 7 are each contained in $\frac{2}{3}$.

(4) Draw lines 4 inches long, and show how often (*a*) $\frac{1}{3}$, (*b*) $\frac{1}{4}$, (*c*) $\frac{1}{6}$, (*d*) $\frac{1}{8}$, (*e*) $\frac{1}{9}$ are contained in them.

(5) Work the following: (*a*) $\frac{3}{5} \div 4$; (*b*) $\frac{2}{3} \div 4$; (*c*) $\frac{5}{7} \div 6$; (*d*) $\frac{4}{9} \div 5$; (*e*) $\frac{5}{8} \div 7$; (*f*) $\frac{5}{6} \div 7$.

(6) Divide (*a*) $4\frac{1}{2}''$ by 3, 4, 5, 6; (*b*) $3\frac{2}{3}'' \div 2$, 5, 7, 9.

(7)



Divide the oblong into thirds. Cut a measurer $\frac{1}{4}$ of the oblong, and find how often it will measure or divide $\frac{1}{3}$. (NOTE.—$\frac{1}{4}$ *measures* $\frac{1}{3}$ $1\frac{1}{3}$ *times.*)

By drawing oblongs 1 inch wide work the following:

(*a*) $\frac{1}{3} \div \frac{1}{4}$; (*b*) $\frac{3}{4} \div \frac{1}{3}$; (*c*) $\frac{4}{5} \div \frac{1}{3}$;
(*d*) $\frac{2}{5} \div \frac{1}{5}$; (*e*) $\frac{5}{6} \div \frac{1}{4}$; (*f*) $\frac{4}{7} \div \frac{1}{5}$.

(8) Draw a line $4\frac{3}{4}''$ long. Show how often $\frac{5}{8}''$ can be cut off.

(9) An oblong contains $\frac{25}{48}$ sq. ft. It is $\frac{5}{6}$ ft. long. What is the width?

(10) If a pint of water weighs $1\frac{1}{4}$ lb., how many pints are there in $5\frac{5}{8}$ lb.?

(11) How long will $6\frac{3}{4}$ lb. of sugar last, if $\frac{3}{8}$ lb. is used each day?

(12) $1\frac{1}{3} \div \frac{1}{3}$; $2\frac{1}{4} \div \frac{3}{8}$; $7\frac{1}{2} \div 1\frac{1}{8}$; $8\frac{2}{5} \div \frac{7}{10}$.

(13) $(1\frac{1}{2}+\frac{3}{4}) \div 1\frac{1}{8}$; $(2\frac{1}{8}+1\frac{1}{3}) \div \frac{1}{6}$; $(7\frac{1}{2}+\frac{3}{8}) \div \frac{5}{12}$; $(2\frac{3}{7}+1\frac{2}{3}) \div 2\frac{3}{7}$

(14) $(8\frac{1}{2}-1\frac{3}{4}) \div 2\frac{7}{8}$; $(6\frac{1}{3}-4\frac{5}{12}) \div 1\frac{5}{6}$; $(5\frac{4}{9}-1\frac{5}{6}) \div 2\frac{1}{4}$; $(8\frac{3}{4}-3\frac{4}{9}) \div 4\frac{1}{6}$.

(15) $(1\frac{1}{2}+2\frac{1}{7}) \div 3\frac{5}{14}$; $(7\frac{1}{2}-1\frac{2}{9}) \div 3\frac{7}{18}$; $(4\frac{1}{3}+1\frac{11}{12}) \div 1\frac{19}{24}$; $(4\frac{5}{6}-1\frac{3}{11}) \div 2\frac{5}{6}$.

(16) A merchant bought $10\frac{1}{2}$ tons of sugar at 17s. 9d. per cwt. What did he pay for it?

(17) Find the area of a plot of land 34·6 m. long and 18·7 m. wide.

(18) From the sum of £2·68 and £1·76 take their difference.

Exercise 17.—Application of Fractions.

(1) A boy used $\frac{1}{4}$ pt. of peas for his garden. He gave $\frac{3}{8}$ pt. to his friend, and had $\frac{1}{6}$ pt. left. What part of a pint had he to start with?

(2) $\frac{3}{5}$ of a business was owned by a merchant. He gave $\frac{3}{8}$ of his share to his son. What part of the whole business did he give away?

(3) A mill is let to four persons. One man has $\frac{3}{8}$ of it, another $\frac{3}{12}$, and another $\frac{1}{4}$. What part has the fourth?

(4) How many pieces of wire $\frac{3}{8}$ ft. long can be cut from a piece $3\frac{3}{4}$ ft. long?

(5) $\frac{1}{6}$ of a piece of cloth is spoilt and $\frac{2}{3}$ is sold. The rest is **12** yards long. What was the length of the piece at first?

(6) A boy lives $3\frac{3}{4}$ miles from his work. If he can go on his bicycle at the rate of $\frac{1}{3}$ mile in **2** min., how long is he on the journey?

(7) A father shared a sum of money among his four sons. To the first he gave $\frac{1}{4}$, to the second $\frac{3}{8}$, and to the third $\frac{1}{3}$. If the fourth got **£50**, what was the amount shared?

(8) A merchant bought a piece of cloth $\frac{5}{8}$ yd. long, and cut it up into samples, each containing $\frac{1}{16}$ yd. How many samples did he make?

(9) A man travelled $\frac{3}{5}$ of a journey by rail, and $\frac{1}{4}$ by boat. The remaining **12** miles were travelled in a taxi-cab. How long was the journey?

(10) From the sum of $1\frac{2}{5}$ and $2\frac{3}{8}$ take $1\frac{2}{10}$.

(11) A man spent $\frac{1}{5}$ of his money, then $\frac{1}{3}$, and then $\frac{3}{10}$. What fraction had he left?

(12) Take $\frac{3}{5}$ of $\frac{2}{3}$ from $\frac{3}{4}$ of $\frac{5}{6}$, and add $1\frac{3}{4}$ to the answer.

(13) Add together the sum and difference of $\frac{5}{12}$ and $\frac{9}{10}$.

(14) From **£5** take the sum of $\frac{3}{8}$ of **10**s. **0**d., $\frac{4}{5}$ of **2**s. **6**d., and $\frac{3}{7}$ of half-a-guinea.

(15) Make up a sum about sharing **50** marbles in unequal parts, and work it.

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(16) A chocolate manufacturer bought $6\frac{1}{2}$ tons of cocoa at **£2**, **14**s. **6**d. per cwt. What did it cost him?

(17) A room **16** ft. square has a carpet **13** ft. square in the middle. Show how to find the area of the rest of the room.

Find the amount of the following bills:

(1) 15 garden spades at 3s. 9d. each; 18 forks at 2s. 8d. each; 25 small trowels at 4½d. each; 18 garden rakes at 1s. 9d. each; 20 hoes at 2s. 3d. each.

(2) 18 shirts at 3s. 11d. each; 5½ doz. collars at 6½d. each; 48 handkerchiefs at 4½d. each; 6½ doz. ties at 7½d. each; 36 pairs of cuffs at 11½d. per pair.

(3) 3 st. 12 lb. of sugar at 2½d. per lb.; 5 st. 10 lb. of tea at 2s. 1d. per lb.; ½ cwt. of coffee at 1s. 7d. per lb.; 4 st. 7 lb. of currants at 6½d. per lb.; 2 cwt. 20 lb. of cheese at 8d. per lb.

(4) 50 yd. 2 ft. of cloth at 5s. 0d. per yd.; 30 yd. 1 ft. of calico at 7½d. per yd.; 45 yd. 1 ft. 6 in. of linen at 1s. 1d. per yd.; 56 yd. 2 ft. of flannel at 9d. per yd.

(5) 12 tons 14 cwt. of best coal at £1 per ton; 18 tons 15 cwt. of seconds coal at 18s. 0d. per ton; 16 tons 5 cwt. of South Wales coal at £1, 5s. per ton; 25 tons 15 cwt. of engine coal at 12s. 6d. per ton.

(6) 10½ lb. of beef at 10d. per lb.; 8½ lb. of mutton at 10½d. per lb.; 7 lb. of veal at 11½d. per lb.; 3 lb. 4 oz. of sausages at 10d. per lb.; 14 lb. of shin beef at 6½d. per lb.

(7) ½ cwt. of nails at 2 lb. for 2½d.; 60 packets of screws at 5d. per packet; 2½ doz. locks at 1s. 9d. each; 50 pairs of hinges at 10½d. per pair; 90 bolts at 4d. each.

(8) 36 gal. 2 qt. of olive-oil at 3s. 9d. per gal.; 24 gal. 3 qt. of sweet-oil at 2s. 8d. per gal.; 6 gal. 3 qt. of salad-oil at 4s. 8d. per gal.; 40 gal. 2 qt. of paraffin-oil at 10½d. per gal.

(9) 3 cwt. 2 qr. 1 st. of potatoes at 9d. per stone; 1 cwt. 1 qr. of apples at 2d. per lb.; 2 sacks of peas, each weighing 2 qr., at 3d. per lb.; 10 cwt. 3 qr. of turnips at 1s. 3d. per stone.

(10) In working the following bill, reckon 9 hr. as a working-day: 5 men's wages, each for 6 dy. 8 hr., at 9d. per hr.; 3 men's wages, each for 4 dy. 4 hr., at 7d. per hr.; 10 men's wages, each for 7 dy. 3 hr., at 10½d. per hr.; 6 men's wages, each for 5 dy. 8 hr., at 8d. per hr.

(11) Make out a grocer's bill for your own family, and work it.

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(12) If it takes 8½ oz. of wool to make a pair of men's stockings, and 6½ oz. to make a pair of socks, how much wool will be needed to make a dozen pairs of each?

Exercise 19.—Common-sense Arithmetic.

(1) A bookseller allows 2d. off in the shilling when selling books. What does he get for 2 books marked 7s. 6d. and 10s. 6d.? If he allowed 3d. off in the shilling, how much would he get?

(2) What is the least piece of string that will go an exact number of times round each of 4 squares with sides 3 in., 4 in., 5 in., and 6 in. long?

(3) When a certain boy is 14 years of age he begins to spend 2d. per week on sweets, and he continues until he is 21 years of age. If he had saved his money, how much would he have had?

(4) A motorist left home at 8 A.M., and completed a journey of 195 miles by 4 P.M. He stopped 45 min. for dinner, and spent the same time in repairing a puncture. What was his speed per hour?

(5) On a wagon are 5 oblong bales of woollen tops, each weighing 5 cwt. The bales are 3 ft. square and 6 ft. long. What is the weight of a cubic yard?

(6) A merchant bought 10000 lb. of yarn at 3s. 0d. per lb. A week after he sold it at 3s. 1½d. per lb. What did he gain?

(7) Beans are planted 3 in. apart. In a school garden there are 10 plots, each 4 yd. wide. How many beans are planted in all the plots if each plot has one row of beans? (*Leave 3 inches at each end of a row.*)

(8) It took 2 men 4 weeks to make 10 garden-plots. They were paid 7½d. per hour. If they worked 9 hr. a day and 6 days per week, what was the average cost of each plot?

(9) A man gave 5 guineas for a watch which lasted 20 years. He had it cleaned once every 2 years at a cost of 3s. 6d. each time. What did the watch cost him per year?

(10) A garden roller is 1 yd. wide and 3½ ft. in diameter. How many times will it turn round in rolling a bowling-green 44 yd. square if it goes over each part once?

(11) A merchant bought 316 gallons of oil for £22, 7s. 8d. Through an accident a quarter of the oil was spoiled, and became worthless; the rest was sold at a gain of 3½d. per gallon. Did the merchant lose or gain, and how much?

(12) A and B are to divide 64 bags of potatoes equally. If, instead of doing that, A takes 35 bags and gives B 12s. 0d., what is the value of a bag of potatoes?

Exercise 20.—Decimalisation of Money.

(1) Write the following in £, s. d.: £24·45; £36·825; £31·125; £41·375; £54·725.

(2) Write the following as decimals: £25, 17s.; £38, 13s.; £24, 12s. 6d.; £48, 15s. 6d.; £37, 5s. 6d.; £14, 17s. 6d.; £16, 19s. 6d.; £8, 9s. 6d.

(3) Find the sum of the following in £, s. d.: £28·625; £40·85; £36·375; £95·825. Work the sum in two ways.

(4) A mill received the following weights of coal in 4 weeks: 25·65 tons, 36·825 tons, 28·775 tons, 26·475 tons. Find the total weight in two ways.

(5) Find in two ways the cost of 5 tons at £1·125 a ton.

(6) A pair of boots cost 12s. 6d. Write the cost as a decimal of £1, and then find the cost of 6 pairs.

(7) In a house ·525 ton of coal is used in a month. How much is used in 8 months at the same rate?

(8) Work the following sums, and give the answers in £, s. d.:
(*a*) £2·675 + £3·125 + £8·65 + £5·375;
(*b*) £·075 + £1·025 + £1·175 + £6·85;
(*c*) £1·35 × 6, 8, 12, 14, 16; (*d*) £2·375 × 5, 20, 25, 40;
(*e*) £2·025 − £1·375; (*f*) £3·525 − £1·075;
(*g*) £3·225 ÷ 3; £6·625 ÷ 5; £8·575 ÷ 7.

(9) First change to decimals, and then work the following:
(*a*) £5, 17s. 6d. + £8, 13s. 6d. + £5, 9s. 6d. + £3, 5s. 6d.;
(*b*) £4, 0s. 6d. + £3, 1s. 6d. + £1, 4s. 6d. + £2, 15s. 6d.;
(*c*) £3, 13s. 6d. − £1, 19s. 6d.; (*d*) £2, 3s. 6d. − £1, 17s. 6d.;
(*e*) 1 ton 15 cwt. × 5, 6, 9, 10;
(*f*) 4 tons 13 cwt. 2 qr. × 3, 7, 8, 10, 11.

(10) I have £5. To how many boys can I give £·025?

(11) A boy said £·05 × 100 was £50. How much was he wrong?

(12) Write down the following as decimals of £1: (*a*) 4s. 6d.; (*b*) 8s. 6d.; (*c*) 12s. 6d.; (*d*) 13s. 6d.; (*e*) 19s. 6d.; (*f*) 15s. 6d.; (*g*) 7s. 6d.

(13) Add together the following: 1·25 of £1, 2·325 of £1, 6·775 of £1, 9·325 of £1. Take the least from the greatest.

(14) 2 tons 15 cwt. of rice were bought at £30, 10s. 0d. per ton. Bring both quantities to decimals, and find the cost.

Learn.—£·025 = 6d.; £·05 = 1s.; £·075 = 1s. 6d.; £·1 = 2s. 0d.; £·125 = 2s. 6d.

Exercise 21.—Miscellaneous Exercises.

(1) A standard of floor boards contains 220 sq. yd. A timber merchant bought 20 standards at 1s. 1d. per sq. yd., and sold them at 1s. 3d. per sq. yd. What did he gain?

(2) A school garden contains 12 plots, each 12 yd. long and 5 yd. wide. What do they cost for making at $4\frac{1}{2}$d. per sq. yd.?

(3) One row of cabbages is planted along the width of each of the above plots. If the cabbages are 1 ft. 6 in. apart, how many are needed for all the plots? (*Allow* 9 *in. at each end.*)

(4) The above plots are fenced with boards at 5d. per yd., and the fixing costs 2d. per foot. What is the total cost of the boards and the fixing?

(5) The total amount spent on seed for the garden-plots was £2, 18s. 6d., and the produce was sold for £4, 5s. 6d. What was the average gain per plot?

(6) The twelve boy-gardeners each worked $2\frac{3}{4}$ hr. per week for 34 weeks. How many minutes was that in all?

(7) Potatoes take up $\frac{1}{3}$ of a plot, peas and beans $\frac{1}{4}$, and cabbages $\frac{1}{8}$. What part of a plot is taken up by these?

(8) Find the cost of these tools for the school garden: 9 spades at £2, 2s. a dozen; 9 forks at 2s. 9d. each; 9 rakes at 18s. 0d. a dozen; 6 hoes at 1s. 10d. each; 12 planting-trowels at $10\frac{1}{2}$d. each; 4 watering-cans at 2s. $10\frac{1}{2}$d. each.

(9) If each boy goes round his garden 6 times each afternoon, how many miles, chains, and yards do all the boys go in a week of 5 days?

(10) In one week each boy emptied on his plot 6 cans of water. Each can holds $1\frac{1}{2}$ gallons. If a pint of water weighs $1\frac{1}{4}$ lb., what weight of water was put on all the plots?

(11) During August the rainfall in the school garden for six days was as follows: 1·15 in., 1·08 in., 1·32 in., ·39 in., ·04 in., and ·28 in. What was the average per day?

(12) To the sum of £1·65 and £3·75, add their difference.

(13) What is the cost of 6 covered packing-cases, each 4 ft. long, 3 ft. wide, and 2 ft. high, at $2\frac{1}{2}$d. per sq. ft.?

(14) 5 pigs are sold for £8, 17s. 6d. What is got for 75 pigs?

(15) Make up a sum about going on a day-trip to the seaside with 15s. 0d., and work it.

Exercise 22.—Term Tests.

A.

(1) (*a*) Show by strips of paper the answer to $\frac{3}{4}'' \times 6$.
(*b*) Make a sketch of a house door, and draw it to a scale of $1'' = 1$ ft.
(*c*) If you had a jam-jar and a piece of thread, how could you find the value of π?
(*d*) Make a triangle, the base $2\frac{1}{2}''$ long, and the angles at the base 45° and 60°.

(2) On Wednesday a grocer sold ·625 of his flour, on Thursday ·175, and on Friday ·075. He had 100 lb. left. How much had he at first?

(3) A grocer bought 4 cwt. of raisins at £2, 14s. 4d. per cwt. He sold half of them at $6\frac{1}{2}$d. per lb., and the remainder at 7d. per lb. How much profit did he make?

(4) From the sum of $4\frac{1}{3}$ and $2\frac{1}{5}$, take their difference.

(5) Work this bill: $15\frac{3}{4}$ lb. of butter at 1s. 4d. per lb.; $6\frac{1}{2}$ pt. of cream at 1s. 7d. per pt.; 11 lb. of cheese at $10\frac{1}{2}$d. per lb.; $13\frac{1}{2}$ lb. of bacon at 9d. per lb.; 4 score eggs at 5 for 4d.

(6) Find the cost of 6 cwt. of iron at £5, 15s. per ton. (*Change the money to the decimal of £1 before working.*)

B.

(1) (*a*) Show by means of a line the answer to ·3 in. × 8.
(*b*) Draw a figure to the scale of $1'' = 1$ ft. to show how many sq. ft. there are in your class-room.
(*c*) A picture is 14 in. by 10 in., and the border round it is 3 in. wide. Show how to find the area of the border.
(*d*) Explain how to find the cost of 48 slates at $4\frac{1}{2}$d. each.

(2) A merchant bought 500 yards of cloth at 3s. $11\frac{3}{4}$d. per yd. 30 yd. had been spoilt in dyeing. The rest was sold at 5s. 0d. per yd. What did he gain?

(3) A floor, 25 yd. long and 22 yd. wide, was covered with blocks of wood each 6 in. square. How many were needed?

(4) Express £3, 8s. 6d. and £5, 17s. 6d. as decimals of £1, and find their difference.

(5) A chemist bought glycerine at 1s. 5d. per lb., and sold it in bottles at 4 oz. for 8d. If each bottle cost him 1d., what profit would he get on a stone?

(6) What is the difference between 3 times the sum of $\frac{2}{3}$ lb. and $\frac{3}{5}$ lb., and 3 times the sum of $\frac{2}{3}$ lb. and $\frac{5}{12}$ lb.?

C.

(1) (*a*) On a map 1 cm. = 30 miles. The distance from London to Bradford by the G. N. Railway is 170 miles. What is the length of the railway line marked on the map?
(*b*) Write as a decimal of £1:—6d.; 1s. 0d.; 2s. 0d.; 2s. 6d.
(*c*) Why cannot a triangle be made with lines 4 in., 2 in., and 1 in. long?
(*d*) Draw a figure to show the best way of finding the area of the four walls of a room.

(2) How much short of £9 is the sum of the following: £8, £·8, £·08, £·008, £·0008?

(3) Change the following fractions into decimals, and find 5 times their sum: $1\frac{1}{2}$; $2\frac{4}{5}$; $2\frac{3}{4}$; $4\frac{9}{10}$.

(4) Find the value of £$\frac{5}{8}+\frac{5}{14}$ guineas $+\frac{3}{5}$ crowns $-\frac{3}{4}$ of 2s. 9d.

(5) From a sack of flour containing $2\frac{1}{2}$ cwt., 17 poor people were supplied with $7\frac{7}{8}$ lb. each. How many lb. remained?

(6) A piece of land, 17·6 Dm. long and 5·4 Dm. wide, is sold at 2 francs per sq. metre. If a franc is worth $9\frac{1}{2}$d., what is the value of the land in English money?

D.

(1) (*a*) $\pi=\frac{22}{7}$. What do 22 and 7 stand for?
(*b*) Draw an oblong to show the answer to $2{\cdot}4\times3{\cdot}5$.
(*c*) Draw an oblong $\frac{1}{2}''$ wide to show the answer to $\frac{3}{4}\times\frac{1}{4}$.
(*d*) Tell how you would make a boy in Class II. understand how many square inches there are in a book-back 8 in. long and 6 in. wide.

(2) Four persons shared a sum of money as follows: one got $\frac{1}{4}$, another $\frac{1}{3}$, another $\frac{1}{5}$, and the fourth took the remainder. What part did the fourth get?

(3) Find the value of ·675 of £1 + ·025 of £1 + 1·125 of £2 − £1·375.

(4) 1·6 Km. = 1 mile. How many miles are there in 320 Km.?

(5) If the poor-rate is $8\frac{1}{2}$d. in the £, the police-rate $11\frac{1}{2}$d. in the £, and the education-rate $9\frac{1}{2}$d. in the £, how much must be paid altogether on £56, 10s.?

(6) Two men start together from the town-hall to cycle in the same direction along the same road. One goes $7\frac{2}{3}$ miles per hour, and the other $8\frac{1}{4}$ miles per hour. How far will they be apart at the end of 4 hours?

Exercise 23.—Aliquot Parts—I.

Work the following sums by means of aliquot parts:—

(1) Find the cost of **378** cwt. of potatoes (*a*) at **6**s. **8**d. per cwt.; (*b*) at **10**s. **0**d. per cwt.

(2) What is the cost of **1000** tons of coal at **£1**, **2**s. **6**d. per ton?

(3) A merchant bought **3000** lb. of wool-tops at **3**s. **4**d. per lb. What did they cost him?

(4) How much does a dealer pay for **2000** zinc buckets at **1**s. **8**d. each?

(5) A firm printed **5000** dictionaries worth **6**s. **8**d. each. What was their total value?

(6) What is the value of **30** pieces of cloth, each **60** yards long, at **5**s. **0**d. per yd.?

(7) Find the cost of **150** tons of turnips at **£3**, **6**s. **8**d. per ton.

(8) A firm buys **400** tons of hay in a year at **£4**, **5**s. **0**d. per ton. What is the amount of the hay bill?

(9) Find the cost of **569** tons of coal (*a*) at **15**s. **0**d. per ton; (*b*) at **£1**, **2**s. **6**d. per ton; (*c*) at **16**s. **8**d. per ton; (*d*) at **17**s. **6**d. per ton.

(10) Find the value of **398** overcoats (*a*) at **£2**, **3**s. **4**d. each; (*b*) at **£1**, **15**s. **0**d. each; (*c*) at **£1**, **16**s. **8**d. each.

(11) A coal merchant bought **2000** tons of coals at **17**s. **6**d. per ton, and sold them at **19**s. **2**d. per ton. If he paid **£10**, **12**s. **6**d. for carriage, what did he gain?

(12) Table-knives are bought at **14**s. **0**d. per dozen, and sold at **18**s. **0**d. per dozen. What is the gain on **1** gross dozen?

(13) **300** navvies are employed in making a reservoir. If each gets **£1**, **6**s. **8**d. per week, what is the wage bill for **6** weeks?

(14) If paving-stones cost **7**s. **6**d. per ton, what is the cost of **3000** tons?

(15) **3600** bags of raw sugar were bought in America at **13**s. **4**d. per bag. What was paid for them?

(16) In July 1913 petroleum cost **£1**, **16**s. **8**d. per barrel. What would a merchant pay for **2000** barrels?

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(17) Find the total cost of **26** lb. of bacon at **11½**d. per lb.; **48** lb. of butter at **1**s. **4**d. per lb.; **16** stones of flour at **1**s. **7**d. per stone; **72** pots of jam at **6½**d. each.

(18) Make up a sum about buying coal for your own home.

Exercise 24.—Aliquot Parts—II.

(1) What is the cost of 600 tons of pig-iron at £4, 13s. 4d. per ton?

(2) In a year a grocer buys 45 tons of sugar. If he pays 17s. 6d. per cwt. for it, what is the amount of his bill?

(3) A coal merchant bought 2000 tons of engine coal at 11s. 8d. per ton. What was the amount of his bill?

(4) Glycerine is £4, 15s. per ton. A firm makes 500 tons in a year. What is the total value?

(5) On a motor-wagon are 8 bales of wool, each weighing 5 cwt. What is the wool worth at 3s. 4d. per lb.?

(6) The rateable value of a village is £2683, and the rate is 6s. 8d. in the £. What is the value of the rates?

(7)

(*a*)	1695	articles at	£2, 15s. 0d. each;
(*b*)	2647	"	" £4, 12s. 6d. "
(*c*)	3268	"	" £5, 5s. 8d. "
(*d*)	347	"	" £6, 11s. 8d. "
(*e*)	496	"	" £7, 13s. 4d. "
(*f*)	1687	"	" £2, 17s. 6d. "

(8) Hay is sold at £4, 15s. 0d. per ton. A carting agent uses 300 tons a year. What is the amount of his hay bill?

(9) Land is 12s. 6d. per square yard. What is the value of a plot 125 yd. long and 48 yd. wide?

(10) 2156 tons of coke were exported from the Tyne docks in a week. The price was 13s. 4d. per ton. What was the value of the coke?

(11) Steel rails are £6, 15s. 0d. per ton. If a railway company ordered 1500 tons, what would the rails cost?

(12) A London merchant bought 3000 tons of coal at Newcastle at 12s. 6d. per ton, and was charged 3s. 4d. per ton for carriage. What did the coal cost him in all?

(13) In July 1913 lead was £19, 12s. 6d. per ton, and copper was £68, 17s. 6d. per ton. What would a merchant pay for 15 tons of each?

(14) Make up a sum about a grocer buying 500 lb. of butter, and work it.

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(15) Two rolls of bacon weighed $56\frac{2}{3}$ lb. and $62\frac{3}{4}$ lb. If half the bacon was sold, how many lb. were left?

(16) $(£2{\cdot}35 \times 4{\cdot}4) + (£3{\cdot}65 \times 6{\cdot}8)$.

Exercise 25.—Weights and Measures—I.

Note.—Set down each step of the working in a separate line.

(1) A table is 2 yd. 1 ft. 6 in. long and 1 yd. 1 ft. wide. What is the area of 6 such tables?

(2) Bring these to fractions of a yard, and then add them together: 3 yd. 9 in.; 6 yd. 2 ft.; 4 yd. 1 ft. 6 in.; 5 yd. 1 ft. 3 in.

(3) What is the cost of 3 tons 15 cwt. of coal at 15s. 8d. per ton?

(4) A yard of cloth cost 5s. 9d. What is the cost of a suit-length measuring 3 yd. 1 ft. 6 in.?

(5) A room is 4 yd. 2 ft. long and 3 yd. 1 ft. 6 in. wide. What does it cost to cover it with carpet at 9s. 0d. per sq. yd.?

(6) If 1 pt. of water weighs $1\frac{1}{4}$ lb., how many gallons of water are required to fill 40 bottles, each holding 20 oz.?

(7) What is the total length of a picture-rail round a room $4\frac{1}{3}$ yd. long and $3\frac{1}{4}$ yd. wide?

(8) A flagstone is $2\frac{1}{3}$ yd. long and 3 ft. wide. How many such flagstones are needed for a causeway 2 chains 12 yd. long and 10 ft. wide?

(9) The leaf of a book is $7\frac{1}{2}$ in. long and $4\frac{3}{10}$ in. wide. If the book contains 32 leaves, what area of paper is there in the book?

(10) If potatoes are sold at 9d. per gal., what is the value of the potatoes in 6 hampers, each holding $22\frac{1}{2}$ gal.?

(11) Tea is 2s. 4d. per lb. What is the value of the tea in a chest containing 24 lb. 12 oz.?

(12) How many rolls of butter, each weighing 20 oz., are needed to make 2 qr. 4 lb.?

(13) How many suit-lengths, each measuring $2\frac{3}{4}$ yd., can be cut from a piece of cloth measuring $60\frac{1}{2}$ yd.?

(14) The carcass of a pig weighs 8 st. 3 lb. 8 oz. What is its value at 11s. 8d. per stone?

(15) A milkman delivers $2\frac{1}{2}$ pt. of milk per day at a certain house. What does the milk bill amount to for July and August at $3\frac{1}{2}$d. per qt.?

(16) Make up a sum about a cheese which weighs 58 lb., and work it.

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(17) I sell $\frac{2}{3}$ of a piece of cloth, then $\frac{1}{4}$, and have 5 yd. left. How many yards were there at first?

Exercise 26.—Weights and Measures—II.

(1) Find the cost of 4 tons 12 cwt. of flour at £5, 12s. 6d. per ton.

(2) A room is 14 ft. 3 in. long and 10 ft. 6 in. wide. What is its area in square feet?

(3) Find the area in square feet of a rectangular courtyard whose length is 26 ft. 6 in. and width 20 ft. 9 in.

(4) Find how many feet a boy would travel if he went $10\frac{1}{2}$ times round the courtyard.

(5) A man bought a flitch of bacon, weighing 50 lb. 8 oz., at $10\frac{1}{2}$d. per lb. What did he pay for it?

(6) A yard is 8 m. 5 dm. long and 6 m. 6 dm. wide. What is its area?

(7) A French lady bought 24·5 m. of calico at ·75 franc per metre. How much did it cost her?

(8) Milk is 1s. 3d. per gallon. What is the milk bill for a confectioner during August, if 6 gal. 2 qt. is the daily quantity used? (*Include Sundays.*)

(9) A causeway is 75 ft. 6 in. long and $10\frac{1}{2}$ ft. wide. Find the cost of making it at 1s. 0d. per sq. ft.

(10) Coal is £1, 2s. 6d. per ton. Find the cost of 2 trucks, each containing 7 tons 5 cwt.

(11) A post-card is $4\frac{1}{5}$ in. long and $3\frac{3}{4}$ in. wide. What is the area of the cards in 8 packets, each containing 25 cards?

(12) How many tiles, each 6 inches square, are needed to cover a passage 25 ft. long and 4 ft. 6 in. wide?

(13) A passage is covered with 200 tiles the shape of a right-angled triangle. If the height and width of each tile is 6 in., what is the area of the passage?

(14) A metre is 39·37 in. long. What is the length in inches of 6 m. 4 dm.?

(15) A kilogram weighs 2·2 lb. What is the weight in lb. of 60 kilograms?

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(16) What is the amount of the following bill: 15 gal. of linseed-oil at 4s. 9d. per gal.; 12 gal. of cod-liver oil at 5s. 3d. per gal.; 25 gal. of paraffin-oil at $10\frac{1}{2}$d. per gal.; 16 gal. of sweet-oil at 11d. per qt.?

(17) Make up a sum about finding the distance between two lamp-posts with your hoop, and work it.

Exercise 27.—Geometrical Construction.

(1) Draw triangles according to the following instructions; then measure the length of *each* side and the size of *each* angle, and write the measurements down:

(*a*) From a certain point two lines are drawn, one **6** cm. long and the other **5** cm. long, making an angle of **60°**. Complete the triangle.

(*b*) Each side of a triangle is **7** cm. long. Draw this triangle.

(*c*) One side of a triangle is **3·4** in. long, and two of the angles contain **50°** and **40°**. Draw this triangle.

(*d*) Two sides of a triangle each measure **4·3** in., and the other side is **2·6** in. long. Draw this triangle.

(*e*) Draw a triangle with one angle **90°**.

(2) Find the answer to each of the following questions by drawing a figure to scale and measuring:

(*a*) In coming to school a boy has to walk $\frac{1}{4}$ of a mile up a road. He then goes $\frac{1}{3}$ of a mile along a road at right angles to the first one. If he could go straight from home to school, how far would he have to walk?

(*b*) A house is **21** ft. high, and a ladder, the bottom of which is **8** ft. from the house, just reaches the top. How long is the ladder?

(*c*) Two ships start from a port at the same time. One goes north at **3** miles per hour, and the other goes west at **4** miles per hour. How far are they apart in **4** hours?

(*d*) A man walks **2** miles along a straight road, and then turns so that he is at an angle of **60°** to the part of the road he has walked over, and walks another **2** miles. How far is he from home now?

(*e*) A wall is **4** feet high, and next it is a causeway **3** feet wide. What is the length of a stick which reaches from the outer edge of the causeway to the top of the wall?

(*f*) A piece of land forms an equilateral triangle. If the sides are each **140** yd. long, find the shortest distance from one corner to the opposite side.

(3) Make angles **90°**, **60°**, **30°**, **45°**, and copy them.

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(4) A gallon of water weighs **1000** oz. What weight of water (in tons, &c.) is there in a barrel containing **48** gallons?

(5) The average price per lb. of a bale of wool weighing $366\frac{1}{2}$ lb. was **23·8**d. What did the bale cost?

(6) (*a*) $(1\frac{1}{2}\times 2\frac{2}{3})+(3\frac{3}{4}\times 2\frac{2}{5})$; (*b*) $(3\frac{1}{5}\times 2\frac{1}{4})-(1\frac{2}{3}\times 1\frac{4}{5})$.

(7) (**3·6** tons + **4·8** tons + **7·6** tons + **3·5** tons) ÷ **1·5**.

Exercise 28.—Ratio.

(1) Write down what fraction of 10s. 0d. each of these sums is: 2s. 6d., 3s. 4d., 6s. 8d., 1s. 8d.

(2) What is the ratio of each of the above amounts to £2?

(3) Write down the ratio of 2 cwt. 2 qr. to 10 cwt.; of 8 lb. to 1 cwt.; of 3 st. to 6 cwt.; of $3\frac{1}{2}$ lb. to 2 stones.

(4) Write down these ratios in their simplest form:
(*a*) 4 in. to 2 ft; (*b*) 3 sq. ft. to 2 sq. yd.;
(*c*) $1\frac{1}{2}$ yd. to 3 chains; (*d*) 5 half-crowns to £2;
(*e*) 1s. 5d. to 8s. 6d.; (*f*) 12 girls to 60 girls;
(*g*) 2 doz. oranges to 1 gross oranges;
(*h*) $5\frac{1}{2}$ score eggs to 10 doz. eggs;
(*i*) 10 cm. to 2 m.; (*j*) 2000 soldiers to 5000 soldiers.

(5) What is the ratio of $3x$ to $12x$? of $10y$ to $50y$?

(6) What is the ratio of 27 m. to 90 m.? of 35 l. to 60 l.?

(7) Write down what sums of money are to £1 in the ratios $\frac{1}{5}$, $\frac{2}{3}$, $\frac{3}{10}$, $\frac{7}{8}$, $\frac{5}{12}$, $\frac{9}{16}$, $\frac{19}{40}$, $1\frac{1}{3}$, $2\frac{3}{5}$, $4\frac{1}{4}$, $3\frac{5}{16}$.

(8) A firm employs 1200 men. 10 out of every 100 are away sick. How many men are working?

(9) A father is 40 yr. 6 mo. old, and his son 15 yr. 8 mo. old. What is the ratio of the son's age to the father's age?

(10) A grocer bought 100 sacks of flour. On Monday he sold 24 sacks, on Tuesday 18 sacks, and on Wednesday 25 sacks. Find the ratio of each day's sale to the whole.

(11) A boy weighs 4 st. 4 lb., and another boy is $\frac{3}{4}$ of this weight. Find the weight of the second boy. What is the ratio of his weight to that of the first boy?

(12) A girl spent £1, 5s. on a dress, and $\frac{2}{5}$ of that amount on boots. What is the ratio of the cost of the boots to that of the dress?

(13) What is a hundredth of £2, 10s.? of 10 tons? of 50 cm.? of 2 m.? of £500? of £1, 13s. 4d.?

(14) What must be put in place of x to make these ratios equal:

(*a*) $\frac{3}{5}=\frac{x}{25}$? (*b*) $\frac{6 \text{ tons}}{x}=\frac{2}{5}$? (*c*) $\frac{15\text{s. } 0\text{d.}}{£3}=\frac{x}{12}$?

(*d*) $\frac{1 \text{ yd. } 1 \text{ ft.}}{x}=\frac{2}{3}$? (*e*) $\frac{6 \text{ cm.}}{2 \text{ m.}}=\frac{9}{x}$? (*f*) $\frac{£1, 4\text{s.}}{£12}=\frac{x}{20}$?

(15) Make up a sum about the ratio of the cost of a boy's suit to that of a girl's dress, and work it.

Exercise 29.—Averages.

(1) A cricket-team made the following runs in 6 matches: 98, 186, 229, 158, 79, 126. What was the average score?

(2) A thermometer at 9 A.M. on 5 successive days was at 68°, 72°, 65°, 62°, 68°. What was the average temperature?

(3) The attendances of boys in a class for 8 half-days were: 45, 43, 42, 39, 46, 41, 38, 42. What was the average attendance?

(4) The number of copies of a daily newspaper sold on five days was as follows: 15640, 14890, 15260, 19280, 16250. What was the average sale per day?

(5) The weight of 8 boys was as follows: 32·5 Kg., 28·7 Kg., 34·3 Kg., 27·6 Kg., 33·2 Kg., 34·3 Kg., 35·8 Kg., 27·6 Kg. What was the average weight?

(6) The ages of 5 boys on 1st January 1914 were 11 yr. 5 mo., 10 yr. 9 mo., 9 yr. 6 mo., 12 yr. 7 mo., and 10 yr. 4 mo. What was their average age?

(7) In eleven innings at cricket I scored 36, 28, 14, 0, 50, 26, 12, 82, 2, 0, and 34. What was my average score?

(8) The rainfall on certain days was as follows: 11th April, ·055 in.; 12th, ·52 in.; 13th, ·01 in.; 14th, 0; 15th, ·19 in.; 16th, ·465 in.; 17th, 0; 18th, ·085 in.; 19th, ·29 in.; 20th, ·15 in. What was the average rainfall per day?

(9) The takings of a draper were as follows: On Monday, £13, 12s. 8d.; on Tuesday, £18, 14s. 9d.; on Wednesday, £16, 17s. 9d.; on Thursday, £17, 18s. 4d.; on Friday, £14, 17s. 4d.; and on Saturday, £34, 14s. 5d. What was the daily average for the week?

(10) A man bought 7 footballs at 2s. 6d. each, and 6 at 3s. 7d. each. What was the average price?

(11) A grocer bought 40 lb. of tea at 1s. 9d. per lb., and 32 lb. at 2s. 6d. per lb. What was the average price per lb.?

(12) The average price of 3 bicycles was 11 guineas each, while a fourth cost £12, 10s. (*a*) What did all the bicycles cost? (*b*) What was the average price of the four?

(13) The total weight of 6 parcels was 26·5 lb. If 4 of them averaged 4 lb. each, and the fifth weighed 4·5 lb., what was the weight of the sixth parcel?

(14) Make up a sum about the average attendances of your class for a week, and work it.

Exercise 30.—Proportion.—Method of Unity—I.

Each line of the statement should be clearly expressed. Thus, in the question, 'If 4 lb. of tea cost 6s., what will you pay for 9 lb.?' the statement should be:

4 lb. of tea cost 6s.,

$\therefore$ 1 lb. of tea cost $\frac{6s.}{4}$;

$\therefore$ 9 lb. of tea cost $\frac{6s. \times 9}{4} = 13s.\ 6d.$

(1) A ham weighing 25 lb. cost £1, 0s. 10d. What would a piece weighing 12 lb. cost?

(2) A train goes 12 miles in 18 minutes. At the same rate, how long would it take to go 40 miles?

(3) 25 francs are worth £1. What is the value of 70 francs?

(4) Five loads of coke cost £3, 10s. What is the cost of 18 such loads?

(5) A man bought 70 rabbits at the rate of 1 dozen for 15s. 0d. What did he pay for them?

(6) A cask of wine containing 26 gallons cost £27, 6s. What would a dozen gallons cost at the same rate?

(7) I bought 40 hens for £7. What is the price of 16?

(8) 108 bricks will build 3 sq. yd. of a wall. How many bricks are needed for a wall containing 10 sq. yd.?

(9) Nails cost 1s. 4d. for 8 lb. Find the cost of 1 cwt.

(10) A chest of tea weighing 56 lb. cost £7. What is the value of 24 lb. of this tea?

(11) A gardener sold his tomatoes at the rate of 4 lb. for 1s. 8d. How much did he get for his crop, which weighed 80 lb.?

(12) A man is paid 9d. for gathering 40 lb. of peas. How many lb. must he gather to earn 6s.?

(13) 5 cwt. of turnips cost 6s. 8d. At this rate, what is the value of 4 tons?

(14) Note-books are sold at £3, 6s. per gross. What would it cost to provide 200 children with these note-books?

(15) It costs £6, 7s. 6d. for 15 persons to go on a certain trip. How much would it cost 29 persons at the same rate?

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(16) What fraction of £3, 10s. is $\frac{4}{7}$ of £1, 11s. 6d.?

(17) Make up a sum about an oil merchant buying oil, and work it.

Exercise 31.—Proportion.—Method of Unity—II.

(1) Eggs are 10 for 1s. 3d. What is the value of 455 eggs?

(2) Calico is sold at the rate of 9 yd. for 3s. 9d. What is the value of a piece 72 yd. long?

(3) 11 books cost 9s. 2d. What is the cost of 42 such books?

(4) In a day of 9 hours a man earns 7s. 6d. How much will he earn in a week of 54 hours?

(5) A draper buys ties at the rate of 9 for 6s. 9d. What does he pay for 6 dozen?

(6) Flour is bought at the rate of 4 stones for 6s. 4d. What is the price of two sacks, each containing 18 stones?

(7) A man can mow 5 acres of grass in 3 days. What time will it take him to mow 35 acres?

(8) A train travels 6 miles in 10 minutes. At this rate, how long will it take to go a journey of 180 miles?

(9) A piece of oilcloth 10 ft. long and 4 ft. wide cost 6s. 8d. What does it cost to cover a floor 14 ft. long and 10 ft. wide with the same kind of oilcloth?

(10) Five garden spades cost 13s. 9d. What is the value of 3 doz. at the same rate?

(11) A bootmaker bought 36 pairs of boots for £13, 19s. What would he get for 14 pairs, if he sold them at a profit of 1s. 9d. per pair?

(12) It took 15 yd. of towelling to make 4 towels. How many towels can be made from 2 pieces, each $67\frac{1}{2}$ yd. long?

(13) In 5 days a mill uses 90 tons of coal. How many tons are needed to last for 10 working weeks of 6 days each?

(14) A piece of linoleum containing 8 sq. yd. cost 30s. What would it cost to cover and fit a room 15 ft. long and 21 ft. wide with this linoleum, if 7s. 6d. were charged for fitting?

(15) I bought 3 tons of coal for £2, 15s. At what price per cwt. must I sell the coal to gain 5s. 10d. per ton?

(16) Three rolls of cotton, each containing 48 yd., were bought for £7, 16s. How much would a piece 14 yd. long be sold for, if a profit of 10s. was made on each roll?

(17) A grocer has teas at 2s. 1d. per lb. and 2s. 6d. per lb. He mixes them in the proportion of 3 lb. of the former to 2 lb. of the latter. Find the value of 9 lb. of the mixture.

(1) Make a sketch of the front of a cupboard in your home. Put on it the dimensions. Scale, $\frac{1}{2}'' = 1$ ft.

(2) Sketch the front of your house. Put on what you think the dimensions are, and draw it to a scale of $\frac{1}{10}'' = 1$ ft.

(3) Draw a sketch of the front of a piano. Put on it the dimensions, and draw it to a scale of $\frac{1}{2}$ in. $= 1$ ft.

(4) Sketch an end and a side of a small oblong haystack. Put on the dimensions, and draw it to a scale of $\frac{1}{8}$ the size.

(5) Draw a sketch of an iron gate, and put on it the dimensions. Make a drawing of it to a scale of $\frac{1}{2}'' = 1$ ft.

(6) Sketch No. 1 on page 3 of cover represents part of some iron railings which have a total length of **16** ft. Make a drawing of them to a scale of $\frac{1}{4}'' = 1$ ft.

(7) Sketch No. 2 on page 3 of cover represents the flower-beds in a park. Draw a plan, to a scale of $\frac{1}{8}'' = 1$ ft., showing what size you think the flower-beds are.

(8) Make a sketch of the front of a shop window. Put on it what you think the dimensions are, and make a drawing to a scale of $\frac{1}{2}'' = 1$ ft.

(9) A field is **3** ch. **10** yd. long and **2** ch. **15** yd. wide. Find a suitable scale, and draw a plan of the field.

(10) A man requires a hen-house for **8** hens. Make a drawing of the front and one side of the size you think best, using a scale of $\frac{1}{2}'' = 1$ ft.

(11) Make a sketch of a garden. Put on it the dimensions, and draw a plan to a suitable scale.

(12) Sketch the plan of a bowling-green with a path round it. Put on the dimensions, and draw it to a scale of $\frac{1}{8}'' = 1$ yd.

(13) Make out a plan for the covering of a room with carpet **4** ft. wide.

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(14) What is the difference between the sum of the two lengths and the sum of the two breadths of an oblong measuring $3\frac{3}{4}$ ft. long and $2\frac{2}{5}$ ft. broad?

(15) Linoleum is **4**s. **6**d. per sq. yd. Find the cost of covering a room **15** ft. long and **12** ft. wide.

(16) What is the value of **350** sheep at **£1, 17**s. **6**d. each? (*Work the sum in two ways.*)

(17) Write these fractions in the simplest form: $\frac{34}{136}, \frac{40}{75}, \frac{48}{104}, \frac{81}{126}$.

Exercise 33.—Symbolic Arithmetic.

(1) Find the value of x in the following:

(a) $2x+12=24$; (b) $5x+24=54$;
(c) $3x+18=96$; (d) $4x+13=73$;
(e) $9x+36=108$; (f) $6x+15=105$.

(2) What is the value of n in the following:

(a) $2n-5=67$; (b) $3n-10=73$;
(c) $4n-11=99$; (d) $5n-25=135$;
(e) $6n-14=110$; (f) $7n-15=120$?

(3) Find the value of m in the following:

(a) $m+\frac{1}{2}=32$; (b) $m+\frac{1}{6}=35$;
(c) $m+\frac{1}{5}=36$; (d) $m+\frac{1}{8}=24$;
(e) $m+\frac{1}{4}=25$; (f) $m+\frac{1}{5}=47$.

(4) What does y represent in the following:

(a) $2y+6=y+48$; (b) $4y+15=y+60$;
(c) $3y+12=y+36$; (d) $2y+14=y+28$;
(e) $5y+17=y+57$; (f) $2y+16=y+22$?

(5) A man said, 'I earn x shillings per week, and my brother earns 36s. 0d.' Together they earn £4 per week. How much does the speaker earn?

(6) A grocer had x lb. of tea in his shop. He bought 1 cwt., and he then had 150 lb. What had he to start with?

(7) A boy had x marbles. He won 7, and then he had 29. How many had he at first?

(8) A certain number is multiplied by 3, and then 14 is added. The answer is 47. What is the number?

(9) A number is multiplied by 3, and then 6 is taken away. The answer is 15. Find the number.

(10) To twice a certain number 13 is added, and the result is 37. What is the number?

(11) There are 6 tables in a shop, each x feet long and y ft. wide. What is the area of all the tables?

(12) A certain garden is twice as long as it is broad. It is 144 feet all round. Find the width.

(13) Make up a sum about x stitches in an inch, and work it.

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(14) Find the cost of 1500 tons of iron at £5, 13s. 4d. per ton.

(15) A garden is 12·4 metres long and 8·6 metres wide. What is its area?

(16) Write £26, 18s. 6d. as a decimal, and express £26·75 in £, s. d.

Exercise 34.—The Circle.

(1) It is **3** feet across the top of a washing-tub. What is the length of the rim round the top?

(2) The minute-hand of the town-hall clock is **3** ft. **6** in. long. How far does the extreme end travel in an hour? Find in furlongs, &c., how far it goes from Sunday at noon to the following Sunday at noon.

(3) A cow was tethered to a rope **14** feet long. It started with the rope tight opposite the cowshed, and kept it so until it got back to the same place. How far had it gone?

(4) The circumference of a band-stand is **29** ft. **4** in. What is the longest straight line that can be drawn inside the stand?

(5) The spoke of a wheel is **3** ft. $2\frac{1}{2}$ in. long. How many feet does the wheel travel in going round **20** times?

(6) The distance from the centre of a circular flower-bed to the edge is **7** yd. How far will a boy walk if he goes round the bed **6** times?

(7) Find the circumferences of circles having radii of:
(*a*) **4·9** cm.; (*b*) **10** ft. **6** in.; (*c*) **6** ch. **7** yd.;
(*d*) **1** fur. **18** yd.; (*e*) **1** ch. $5\frac{1}{2}$ yd.; (*f*) **6** ft. **7** in.

(8) What are the diameters of circles having circumferences of:
(*a*) **4·4** metres; (*b*) **3** fur.; (*c*) **2** chains **11** yd.;
(*d*) **7** yd. **1** ft.; (*e*) **1** mile; (*f*) $2\frac{1}{2}$ miles?

(9) The diameter of a motor-car wheel is **2** ft. **4** in. What distance will the car travel while this wheel turns round **400** times?

(10) The driving-wheel of a traction-engine is **10** ft. **6** in. in diameter. How many times will it turn round while the engine travels **2** miles?

(11) At a railway station there are **30** milk-cans, each **5** ft. **6** in. round. How far would they reach if placed side by side, and touching each other, in a straight line?

(12) Make up a sum about a hoop, and work it.

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(13) Find the cost of **500** copies of a book at **£1, 17s. 6d.** each. (*Work the sum in two ways.*)

(14) A field is **25·6** metres long and **19·4** metres wide. What is the area?

(15) Wool is $17\frac{3}{8}$d. per lb. Find the cost of **258** lb.

(1) An acre of land produced on an average 17·25 bushels of wheat. How much was got from 4·5 acres?

(2) The rainfall for four days was ·57 in., ·06 in., ·08 in., and ·27 in. For the month it was 2·16 in. How much rain fell on the other days?

(3) A cyclist travelled at the rate of 7·65 m. per hour. What distance did he go in 6·5 hr.?

(4) One man mows ·68 acre in a day, and another ·55 acre. How much will one mow more than the other in $7\frac{1}{2}$ days?

(5) A poker is 1·5 ft. long. How many pokers can be made from a piece of iron 22·5 ft. long?

(6) 65·75 metres of cloth cost 4·5 francs per metre. What was the total cost?

(7) Find a in the following:
(a) 4·75 in. + 3·05 in. + 8·65 in. + 4·35 in. + ·08 in. = a;
(b) (£3·75 + £2·68 + £7·76) − (£2·35 + £6·24 + £·75) = a;
(c) (6·45 tons × 2·5) + (4·65 tons × 3·6) = a;
(d) (£2·63 × 6·4) − (£1·78 × 2·8) = a;
(e) (£55·5 ÷ 1·5) + (£75·6 ÷ ·9) = a;
(f) (58·5 tons ÷ 2·6) − (93·6 tons ÷ 6·5) = a.

(8) There are 6 houses in a row, and the gardens are 7·6 metres long and 5·4 metres wide. What is the combined area of all the gardens?

(9) How often can £·45 be taken from £11·25?

(10) Find by decimals the cost of 2 tons 14 cwt. of hay at £3, 12s. 0d. per ton. (*Answer in decimals.*)

(11) Wool is bought at 16·75d. per lb., and sold at 18·5d. per lb. What profit is made on 2000 lb.?

(12) 22·5 lb. of tea cost 56·25s. What is the value of 4·5 lb.?

(13) Make up a sum about cutting up a board 12·5 ft. long, and work it.

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(14) In a team of 11 bowlers, 9 averaged 18 points each. The others made 19 and 21 points. What was (a) the total score of the team? (b) the average score per man?

(15) If 16 men earn £90 in 45 days, how much will 24 men earn in the same time?

(16) How much is £1, 8s. $10\frac{1}{3}$d. less than £3, 2s. $6\frac{1}{4}$d.?

Exercise 36.—Trade Accounts.

(1) Work the following in as short a way as possible:
- (*a*) Find the cost of 24 lengths of picture-moulding, each 12 ft. long, at $2\frac{3}{4}$d. per foot.
- (*b*) What is the value of 1 ton of butter at 11d. per lb.?
- (*c*) What is the cost of 1000 sacks of wheat at 17s. 6d. per sack?
- (*d*) What is the value of 6 barrels of paraffin-oil, each containing 36 gal., at $10\frac{1}{2}$d. per gallon?
- (*e*) What will 12 gross boxes of wax-matches cost at $\frac{3}{4}$d. per box?

(2) Work the following bills:
- (*a*) 15 umbrellas at 7s. 6d. each; 4 doz. ties at 1s. $11\frac{1}{2}$d. each; 1 gross of shirts at 4s. 3d. each; $1\frac{1}{2}$ gross of collars at 2s. 6d. for 6; 100 handkerchiefs at $4\frac{1}{2}$d. each.
- (*b*) 3 cheeses, each weighing 40 lb., at 9d. per lb.; 150 lb. of bacon at 10d. per lb.; 2 cwt. of sugar at $2\frac{1}{2}$d. per lb.; 1 gross boxes of sardines at $10\frac{1}{2}$d. each.
- (*c*) 3 gross of lead-pencils at $6\frac{1}{2}$d. per doz.; 20 quires of paper at 3d. per quire; 6 doz. bottles of ink at $4\frac{1}{4}$d. each; 2 gross of exercise-books at 8d. per dozen.
- (*d*) 24 yd. of dress materials at 1s. 9d. per yd.; 24 doz. yd. of calico at 5d. per yd.; 4 doz. pairs of socks at 2s. 9d. per pair; 2 doz. pairs of gloves at 2s. 11d. per pair.

(3) What is the cost of 480 tons of coal at 19s. 11d. per ton? (*Work this sum in two lines.*)

(4) Bricks are 36s. 0d. per 1000. What was the cost of building a chimney which required 500000 bricks?

(5) A spirit merchant sold wine at a gain of 5s. 6d. per gallon. What did he charge for 24 gallons, if he gave £1, 2s. 6d. per gallon for it?

(6) A tea merchant bought 2 cwt. of tea at 1s. 7d. per lb., and 1 cwt. at 1s. 10d. per lb. He mixed these, and sold the mixture at 2s. 4d. per lb. What did he gain?

(7) 200 sacks of wheat, each weighing 240 lb., are put into two trucks. If each truck, when empty, weighs $3\frac{3}{4}$ tons, what is the total weight of the loads?

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(8) What is the average weight of 4 boys whose weights are: 5 st. 4 lb.; 4 st. 12 lb.; 5 st. 10 lb.; and 4 st. 6 lb.?

(9) If a man had £1, 16s. 0d. per week, show how it might be spent.

Exercise 37.—Metric System—Square Measure.

(1) Letting **1** centimetre stand for a metre, draw a figure to show an are. Colour $\frac{1}{10}$ of the diagram blue, and say what it represents.

(2) Let **1** decimetre stand for a metre. Draw a diagram to show a centiare.

(3) On a scale of **1** centimetre to the metre, draw an oblong to show **1** are.

(4) Using a scale of **1** centimetre to the metre, show how often **20** square metres are contained in **1** are.

(5) Find the number of ares in (*a*) **8** hectares; (*b*) **125** square metres; (*c*) **25** hectares + **137** square metres.

(6) A piece of cloth is **25·4** metres long and **·75** dm. wide. What is its area in square metres?

(7) A field is **57·2** metres long and **25·5** metres wide. Find the area in ares, &c.

(8) A vineyard is **125** metres long and **74** metres wide. What is the area in ares, &c.?

(9) Show by a diagram how many plots of land, each **5** metres square, can be cut from **2** ares.

(10) A causeway is **100** metres long and **3** metres wide. How many flagstones **1** metre long and **·5** metre wide are needed to pave it?

(11) How many centiares are there in a field **54** metres long and **27** metres wide? How many ares is that?

(12) If land is **1·5** francs per square metre, what is the value of a piece of land **55** metres long and **30** metres wide?

(13) Write down **346** hectares in as many ways as you can.

(14) A box is **9** dm. long, **6** dm. wide, and **5** dm. high. What is the total outside area of **20** such boxes? (*Reckon the lid.*)

(15) If turf is **·25** franc per square metre, what will it cost for sufficient turf to cover a lawn **40** metres square?

(16) Make up a sum about the area of a field in French measure, and work it.

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(17) If a man earns £**5**, **8**s. **0**d. in **3** weeks, how much will he earn in **15** weeks at the same rate?

(18) What is the value of **50** pieces of cotton, each **60** yd. long, at **4**$\frac{1}{2}$d. per yd.?

Exercise 38.—Application of Square Measure.

(1) A passage **28** ft. long and **8** ft. **9** in. wide is covered with tiles at a cost of **2**s. **9**d. per sq. ft. Find the total cost.

(2) A table is **8** ft. long and **5** ft. wide. A tablecloth is needed for this which overlaps **1** ft. on each side. What must be its area?

(3) A room is **18** ft. long and **15** ft. wide. How many yards of carpet, **27** in. wide, are needed to cover it?

(4) What does it cost to carpet a bedroom **15** ft. long and **12** ft. wide with carpet **27** in. wide, at **4**s. **6**d. per yd.?

(5) A room of a club is **66** ft. long and **36** ft. wide. It is covered with linoleum at **5**s. **6**d. per yd. If the linoleum is **2** yd. wide, how much did it cost to cover the room?

(6) A room is **12½** ft. long, **10½** ft. wide, and **9** ft. high. What is the area of the walls, excluding the window and the door, which occupy **40** sq. ft.?

(7) What is the cost of papering the room in question (6) with paper **24** in. wide, at **4½**d. per yd.?

(8) A room is **16** ft. long and **13** ft. **6** in. wide. What is the cost of covering it with carpet at **4**s. **8**d. per sq. yd.?

(9) What will it cost to cover a kitchen **14** ft. long and **12** ft. wide with matting **36** in. wide, at **1**s. **3**d. per yd.?

(10) How many yards of matting **2** ft. **6** in. wide are required to cover the floor of a room **17** yd. long and **13** yd. wide?

(11) What would it cost to paper a room **16** ft. long, **12** ft. wide, and **9** ft. high with paper **18** in. wide, at **1½**d. per yd.?

(12) How many planks, each **15** ft. long and **10½** in. wide, are required for a platform **45** ft. long and **14** ft. wide? Find the cost at **4½**d. per sq. ft.

(13) How many tiles, each **6** in. square, are required to cover a floor **21** ft. **6** in. long and **14** ft. **6** in. wide?

(14) Make up a sum about covering the floor of your kitchen with oilcloth, and work it.

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(15) (*a*) $\frac{\text{23 ch. 14 yd. 1 ft.}}{\text{2 yd. 1 ft.}}$; (*b*) $\frac{\text{100 guineas}}{\text{17s. 6d.}}$; (*c*) $\frac{\text{41 cwt. 19 lb.}}{\text{1 qr. 25 lb.}}$

(16) What is the cost of **45** tons **15** cwt. of coke at **11**s. **6**d. per ton?

Exercise 39.—Bills.

(1) Make out the following bill in proper form, and settle it: $5\frac{1}{2}$ lb. of cheese at $9\frac{1}{2}$d. per lb.; $4\frac{1}{2}$ lb. of butter at 1s. 4d. per lb.; $1\frac{1}{2}$ lb. of tea at 1s. 10d. per lb.; $\frac{3}{4}$ lb. of biscuits at 10d. per lb.; 20 eggs at 2 for $1\frac{1}{2}$d.

(2) Work the following bill, allowing 2d. off for each complete shilling: 15 yd. of calico at $5\frac{1}{2}$d. per yd; 18 yd. of flannel at $8\frac{1}{2}$d. per yd.; 25 yd. of muslin at $10\frac{1}{2}$d. per yd.; $3\frac{1}{2}$ dozen reels at 2 for $2\frac{1}{2}$d.; 22 yd. of print at $9\frac{1}{2}$d. per yd.

(3) Make out the following bill, allowing 1d. off for each complete shilling: 35 lb. of mangel seed at £3, 10s. per cwt.; 24 bushels of oats at 50s. per qr.; 5 cwt. of nitrate of soda at $2\frac{1}{2}$d. per lb.; $\frac{1}{2}$ ton of seed potatoes at 11d. per stone.

(4) Make out the following bill, allowing 3d. discount for each complete 5s. 0d.: 13 quarters of bean-meal at 34s. 4d. per qr.; $5\frac{1}{2}$ quarters of pea-meal at 35s. 6d. per qr.; 15 quarters of wheat at 33s. 6d. per qr.; 11 quarters of oats at 38s. 6d. per qr.; 14 quarters of maize-meal at 26s. 9d. per qr.

(5) Work the following, using only two lines for each item:
(*a*) 3 gross of cabbages at $1\frac{1}{4}$d. each.
(*b*) 100 garden spades at 2s. 9d. each.
(*c*) 4 tons of straw at 4s. 8d. per cwt.
(*d*) Hay is £3, 15s. per ton. What is the price per cwt.?
(*e*) 12 gross of matches at $1\frac{1}{2}$d. per doz.
(*f*) What is the cost of 3 cwt. of sugar at $1\frac{3}{4}$d. per lb.?
(*g*) Find the price of 1 lb. of apples at £1, 3s. 4d. per cwt.

(6) Make out the following bill, and work it: 5 dozen hammers at $9\frac{3}{4}$d. each; 72 screw-drivers at 1s. $0\frac{1}{2}$d. each; 3 st. 8 lb. of nails at $2\frac{1}{2}$d. per lb.; 38 chisels at 1s. $1\frac{1}{2}$d. each.

(7) Make out a draper's bill for your own family, and work it.

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(8) A draper bought 42 yd. of serge. One person bought $5\frac{4}{5}$ yd., and another bought $4\frac{3}{4}$ yd. How much was left?

(9) A room is 21 ft. long and 18 feet wide. It is covered with carpet 27 in. wide. What is the cost at 6s. 9d. per yd.?

(10) If the room in question (9) is 10 feet high, how much paper will be needed for the walls, allowing 36 sq. ft. for window and door?

(11) Find the value in tons, &c., of:
2·65 tons + 3·125 tons + 4·75 tons + 1·25 tons.

Exercise 40.—Vulgar Fractions—Combined Rules.

(1) $\frac{1}{3}$ of a field is sown with oats, $\frac{1}{4}$ with wheat, and $\frac{1}{8}$ with clover. If the rest of the field is sown with barley, what fraction is this of the whole field?

(2) A man bought $\frac{3}{4}$ ton of hay. Half of it was bad. What fraction of a ton was good?

(3) If $3\frac{1}{3}$ lb. of tea cost 5s. 10d., what was the cost of $1\frac{1}{2}$ lb.?

(4) What is the value of $5\frac{5}{8}$ tons of coal at 15s. 8d. per ton?

(5) Work the following:
- (*a*) $\frac{5}{6}$ of £1 + $\frac{3}{5}$ of £4, 10s. + $\frac{2}{3}$ of 5 guineas.
- (*b*) $\frac{5}{8}$ of 2 tons + $\frac{3}{4}$ of 15 cwt. + $\frac{2}{7}$ of 5 stones.
- (*c*) $\frac{4}{11}$ of 2 st. 5 lb. + $\frac{3}{5}$ of $2\frac{1}{2}$ lb. + $\frac{3}{7}$ of 1 cwt.
- (*d*) What fraction of 2 tons is 3 cwt.? 15 cwt. 2 qr.? 4 st.?
- (*e*) What part of a guinea is 3s. 6d.? 2s. 9d.? 15s. 3d.?
- (*f*) $\frac{3}{7}$ of 2 guineas + $1\frac{7}{8}$s. + $\frac{4}{5}$ of £3, 10s.

(6) Work the following:
- (*a*) $1\frac{2}{3} + 2\frac{3}{5} + 1\frac{1}{10} + 1\frac{5}{6}$;
- (*b*) $(1\frac{3}{8} + 2\frac{2}{3}) - (1\frac{3}{4} + 2\frac{1}{6})$;
- (*c*) $\frac{3}{4} \times (\frac{8}{9}$ of $\frac{6}{7})$;
- (*d*) $(3\frac{2}{3}$ of $2\frac{1}{5}) \times 1\frac{5}{11}$;
- (*e*) $2\frac{1}{2} \div 1\frac{4}{11}$;
- (*f*) $3\frac{1}{3} \div 1\frac{1}{9}$.

(7) A milkman has 5 cans filled with milk, and another can $\frac{2}{5}$ full. Each can holds $1\frac{2}{3}$ gallons. How much milk has he?

(8) A boy sold $\frac{2}{5}$ of his marbles one day, $\frac{1}{3}$ the next, and had 40 marbles left. How many had he at first?

(9) Work the following by means of fractions:
- (*a*) Find the cost of 5 boards, each 4 yd. 1 ft. 6 in. long, at $5\frac{1}{2}$d. per yd.
- (*b*) What is the combined area of 4 tables, each 7 ft. 9 in. long and 3 ft. 6 in. wide?
- (*c*) The area of a table is 25 sq. ft. The width is $3\frac{1}{3}$ ft. What is the length?
- (*d*) How often can a piece of string $2\frac{1}{5}$ ft. long be cut from a piece measuring $19\frac{4}{5}$ ft.?

(10) A boy spent $\frac{2}{3}$ of his money on a bat, and $\frac{1}{2}$ of what he had left on a ball. What part of his money was left?

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(11) 14 yd. of silk cost £3, 17s. What is the cost of 3 yd.?

(12) How many pieces of wire, each 25 cm. long, can be cut from a piece containing 20 metres?

(13) Make up a sum about $\frac{1}{3}$ of a cake, and work it.

Exercise 41.—Graphs.

Solve the following problems by graphic methods:

(1) A girl can make **36** blouses in **8** hours. How long will it take her to make **27** blouses? How many blouses can she make in **6** hours?

(2) How much should be paid to a man for **35** hours' work, if he is paid **6**s. **9**d. for **9** hours?

(3) If **20** lb. of apples cost **5**s. **0**d., how many lb. can be bought for **3**s. **9**d.? for **2**s. **6**d.? for **6**s. **0**d.?

(4) A joiner received £**2**, **5**s. for **54** hours' work. How much should he get for **18** hours' work?

(5) **3** pigs are worth as much as **10** sheep. How many pigs can be exchanged for **50** sheep?

(6) A motor-car goes **5** miles in **12** min. Find its rate per hour. How far would it go in **4** hr.?

(7) A boy takes **50** steps in going **40** yd. How many yards will he go in taking **75** steps?

(8) A post **9** feet long casts a shadow **15** feet long. What will be the length of the shadow of a flag-staff **45** feet long?

(9) **15** stones of wheat cost **17**s. **6**d. What is the value of **3** sacks, each containing **18** stones?

(10) A train goes at the rate of **45** miles per hour. Draw a graph of this rate, and find how far the train travels in **45** minutes.

(11) By means of a graph find the cost of **35** cwt. of coal at **18**s. **0**d. per ton.

(12) The maximum temperature for the first ten days in July 1913 was **69°**, **70°**, **72°**, **68°**, **57°**, **65°**, **61°**, **57°**, **59°**, **62°**. Show these results on a graph.

(13) If **1** metre = **1·1** yd., draw a graph to show this, and by means of it find how many metres there are in **4·95** yd.

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(14) What is the difference in price between a ton of sugar at **2**$\frac{1}{4}$d. per lb. and the same quantity of tea at **1**s. **7**d. per lb.?

(15) During 1913, **1246884** tons of pig-iron were exported from the Tees, and during 1912, **1340097** tons were exported. What is the difference?

(16) A Middlesbrough merchant sold **1500** tons of pig-iron at £**2**, **9**s. **11**d. per ton. What did he get for it?

Exercise 42.—Common-sense Arithmetic.

(1) One woman bought 2 stones of flour per week at a grocer's shop, and paid 1s. 7d. per stone. Another bought the the same quantity at another shop, and paid 1s. 9d. per stone, but received 3s. 0d. in the £ discount. What is the difference between the amounts really paid in 30 weeks?

(2) A box without a lid is 1 ft. 6 in. long, 8 in. wide, and 6 in. deep. The inside has to be covered with zinc. How many sq. feet of zinc are needed?

(3) A man grew 200 celery-plants, and sold them for £1. He sold 100 of them for 7s. 6d. At what rate per plant did he sell the others?

(4) An unfinished piece of cloth measured 60 yd. After dyeing and finishing, it measured $57\frac{5}{8}$ yd. What was the total shrinkage for 300 such pieces?

(5) It took 12500 bricks, at 42s. per 1000, to build a wall. 4 loads of mortar were used, at 7s. 6d. per load, and £15 was paid for labour. What did the wall cost?

(6) A sack of wheat weighed $2\frac{1}{2}$ cwt., and cost 1s. 0d. per stone. What would be the value of 200 sacks?

(7) If a pair of horses brought the wheat in question (6), 30 cwt. in a load, how many journeys would they make, and what weight would form the last load?

(8) A mason is paid $9\frac{1}{2}$d. per hour, and a labourer 7d. per hour. What does a contractor pay 6 masons and 6 labourers for a week of 54 hours?

(9) Make out an account for the following: Received 28s. 0d. from husband, 9s. 0d. from son, and 15s. 0d. from lodger. Spent 7s. 6d. for rent, 3s. 9d. for coal, 13s. 6d. for groceries, 6s. 5d. for meat, 2s. $1\frac{1}{2}$d. for milk, 2s. 10d. for vegetables, and 2s. 7d. for sick club and insurance.

(10) A family uses 1 stone of potatoes each week. If the average cost is 9d. per stone, what could be saved in a year by buying them in sacks, each containing 9 stones, at 5s. 3d. per sack?

(11) The profits on a fishing-boat are shared thus: ·5 goes to the owner, ·1 to the captain, ·1 to the two mates, and the rest is shared equally among a crew of 6. If each member of the crew gets £3, what are the total profits?

(12) Mother allows 5s. 0d. a week for meat and fish. Show how she can spend this for her husband, self, and two boys.

Exercise 43.—Miscellaneous Exercises.

(1) Find the cost of **2500** tons of pig-iron at **£4**, **7**s. **6**d. per ton.

(2) A grocer sold **55** stones of flour in **6** days. How long will **180** stones last at this rate?

(3) A dealer bought **45** cows for **£765**. He sold two for **£38**. For what sum must he sell each of the rest so as to gain **£47** on the whole?

(4) If a clock ticks once per second, how many times does it tick during the first four months of an ordinary year?

(5) Work this bill: **10**½ lb. of apples at **2**s. **9**d. per stone; **1**¾ lb. of grapes at **3**s. **6**d. per lb.; **10** stones of potatoes at **3**½ lb. for **2**½d.; **3** stones of onions at **4** lb. for **5**d.

(6) From a plank **18** ft. long **5** pieces, each **10**⅝ in. long, are cut off. (*a*) How much is left? (*b*) How much is the remainder less than **15** ft.?

(7) Hops in 1905 produced on an average **14·21** cwt. per acre. What weight was obtained from **150** acres?

(8) What is the cost price of **4** tons **15** cwt. of Cheddar cheese at **72** shillings per cwt.?

(9) Wheat is **32**s. **9**d. per quarter. What is the value of **8** quarters **4** bushels?

(10) A man paid **·25** of a sum of money to one person, and **·35** of it to another. He had **£20** left. How much had he at first?

(11) A brick is **9** in. long and **4** in. wide. How many are required to pave a floor **16** ft. long and **12** ft. wide?

(12) A dealer bought **34** horses at **£26**, **10**s. each. He sold **13** at **£31**, **5**s. each, and the remainder at **£29**, **15**s. each. What did he gain?

(13) How many pieces of wood, each **9**⅜ in. long, can be cut from a piece **6** ft. **3** in. long?

(14) What is the value of **·25** of **£2**+**·75** of **£3**, **10**s.+**1·5** of **£4**, **10**s.?

(15) Make up a sum about buying a dress or a suit, if there is **£2**, **10**s. to start with.

(16) A room **15** ft. long and **12** ft. wide has a border of oilcloth **2** ft. wide all round it. How much carpet is needed to cover the remaining part?

(17) Find the cost of **5** gross of ties at **9**½d. each.

Exercise 44.—Miscellaneous Exercises.

(1) What is the value of 6 packages of hops, each weighing 1 cwt. 3 qr. 14 lb., at £3, 12s. 6d. per cwt.?

(2) An oblong was $5\frac{3}{8}$ in. long and $3\frac{7}{12}$ in. wide. Find (*a*) the perimeter; (*b*) the difference between the sum of the two long sides and the sum of the two short sides.

(3) A grocer bought 1 ton 3 cwt. 3 qr. of sugar at 2s. 1d. per stone. What did it cost him?

(4) A farmer sold 36 quarters 6 bush. 3 pecks of potatoes at 9d. per peck. If he paid 1d. per peck for the gathering, and £2, 14s. 6d. for carriage, how much had he for himself?

(5) The rainfall for 4 days in June 1913 was ·555 in., ·045 in., ·244 in., and ·1 in. What was the average per day?

(6) Write down the ratios between 3s. 6d. and £1, 1s. 0d.; 2 stones and 2 cwt.; 3 ft. 6 in. and 10 ft. 6 in.

(7) Work the following bill, and settle it: 25 joiners' saws at 4s. 9d. each; 30 jack-planes at 5s. 6d. each; 26 hammers at 1s. 9d. each; $4\frac{1}{2}$ doz. inch-chisels at $7\frac{1}{2}$d. each.

(8) A tinsmith can make 24 cases in 5 days. How long would it take him to complete an order for 1 gross?

(9) The inside of a building is 90 ft. long, 36 ft. wide, and 15 ft. high. What would it cost to colour the walls at 5d. per sq. yd.?

(10) If 6 books cost 7s. 6d., make a graph to show the cost of 24 books, of 36 books, of 40 books, and of 48 books.

(11) Write down 365·4 Kg. as grams; 26·8 Kl. as litres; 3 hectares 6 ares as sq. metres.

(12) Work the following: (*a*) $3x-7=37$; (*b*) $6x-\frac{1}{2}=49$; (*c*) find the cost of x lb. of tea at y pence per lb.

(13) How often can £·225 be taken from £9·45?

(14) At Liverpool a wholesale greengrocer bought 2000 barrels of apples at 6s. 8d. per barrel. He paid 2d. per barrel for carriage, and sold them at 9s. 0d. per barrel. What did he gain?

(15) Make up a sum about any part of your work.

(16) How much paper is needed for a room 14 ft. long, 12 ft. wide, and 10 ft. high, if 40 sq. ft. are taken up by the window and the door?

Exercise 45.—Term Tests.

A.

(1) (*a*) The end of a canister is 2 in. in diameter. Explain how you would find the circumference.
(*b*) Sketch the front of a chest of drawers, and put on it the dimensions.
(*c*) Show by means of crayons how to find $3{\cdot}6 \div {\cdot}9$.
(*d*) Explain how you would find the cost of 37 lb. of bacon at $10\frac{1}{2}$d. per lb.

(2) Add together the sum and difference of $1\frac{5}{8}$ in. and $1\frac{2}{3}$ in. What does $1\frac{1}{6}$ times the answer come to?

(3) A motor-car goes 15 miles in 75 min. How far does it travel in 3 hours at this rate?

(4) Mr A. offered to supply 2000 tons of coal at 18s. 9d. per ton. Mr B. got the order because he quoted $1\frac{1}{2}$d. per ton less. What was the total difference between the prices?

(5) A packing-case is 3 ft. 6 in. long, 3 ft. wide, and 3 ft. 6 in. deep. What does it cost to cover the outside of 12 such cases with tin at $2\frac{1}{2}$d. per sq. ft.?

(6) Make out the following bill, and settle it: 47 lb. of bacon at 11d. per lb.; $\frac{1}{2}$ cwt. of cheese at $9\frac{1}{2}$d. per lb.; 28 lb. of butter at 1s. 2d. per lb.; 2 cwt. of sugar at $2\frac{1}{4}$d. per lb.; 500 eggs at 25 for 1s. 6d.

B.

(1) (*a*) Draw a figure to show how to find the area of a triangle.
(*b*) By means of crayons show how to multiply 3·5 in. by ·4.
(*c*) Draw a triangle having one angle 60°, and two sides each $2\frac{1}{2}$ in. long.
(*d*) Explain how to multiply by 25 in the shortest way.

(2) Add together the sum and difference of 3·65 in. and 5·34 in., and divide the answer by 2·4.

(3) A father said, 'My age is just 3 times that of my son.' Together their ages were 56 years. How old was each?

(4) 70 lb. of bacon cost £3, 4s. 2d. How much was it per stone?

(5) How many sq. yd. of paper are required for a room 16 ft. long, 12 ft. wide, and 9 ft. high, if the windows and door occupy 16 sq. yd.?

(6) A chemist buys 28 lb. of glycerine at 1s. 3d. per lb. He sells it in 4-oz. bottles at 6d. each. If the bottles cost him $\frac{1}{2}$d. each, what profit does he make?

C.

(1) (*a*) Make a triangle with two sides 3·4 in. and 3·1 in., and one angle 60°.
(*b*) Give the best way of finding the cost of 90 yd. of muslin at 11½d. per yd.
(*c*) Write 3·612 Kg. in 4 different ways.
(*d*) Give £13, 16s. 6d. as a decimal.

(2) If a firm bought 1500 tons at £2, 7s. per ton, and paid 16s. 6d. per ton for carriage, what was the total cost?

(3) Carpet is 6s. 8d. per sq. yd. What will it cost to cover a room 18 ft. long and 15 ft. wide?

(4) It takes a train 15 min. to go from Bradford to Leeds, a distance of 9 miles. How long would it take to go from Leeds to London, a distance of 185 miles, at this rate?

(5) Make out the following bill, and settle it: 66 yd. of calico at 5½d. per yd.; 80 yd. of flannel at 9½d. per yd.; 56 yd. of print at 8½d. per yd.; 200 buttons at 3d. per dozen; 100 reels of cotton at 1½d. each.

(6) A room is 28 ft. 9 in. long and 16 ft. 8 in. wide. What is the area of the floor? (*Work by vulgar fractions.*)

D.

(1) (*a*) Write down the value of £5·65 in £, s. d.
(*b*) Sketch the plan of a garden, and put on it the dimensions.
(*c*) If x lb. of tea cost y shillings, what is the price per lb.?
(*d*) The circumference of a wheel is 11 ft. What is the radius?

(2) A man works from 7 A.M. to 8.30 A.M., from 9 A.M. to 12.30 P.M., and from 1.30 P.M. to 5.30 P.M. How many hours does he work in 6 weeks? (6 *days per week.*)

(3) What is the cost of 38·6 Kg. of flour at 1·7 francs per Kg.? What change would there be out of a 100-franc note?

(4) A sack of potatoes, weighing 10 stones, cost 5s. 10d. How much would a ton cost at this rate?

(5) Sketch No. 3 on page 3 of cover is the plan of a piece of ground. Copy it and find the area.

(6) A bag of marbles was divided among 4 boys. The first got $\frac{1}{8}$, the second $\frac{1}{3}$, and the third $\frac{1}{4}$. The fourth boy got 42. How many marbles were there in the bag?

Exercise 46.—Application of Previous Rules—I.

Add the following both in horizontal rows and in columns, using no scrap-work:

(1)

	(*a*)			(*b*)			(*c*)			(*d*)		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1.	236	19	$9\frac{1}{4}$	4987	13	8	428	15	9	674	15	$8\frac{1}{2}$
2.	197	15	$8\frac{3}{4}$	2375	14	$9\frac{1}{2}$	897	14	$10\frac{1}{2}$	876	14	$9\frac{1}{2}$
3.	874	17	$10\frac{1}{4}$	6784	15	$7\frac{1}{4}$	387	13	$11\frac{1}{4}$	892	15	4
4.	923	15	$10\frac{1}{2}$	6923	7	$6\frac{1}{4}$	738	17	$9\frac{1}{2}$	547	13	$9\frac{1}{2}$
5.	387	12	$7\frac{3}{4}$	9142	14	$7\frac{3}{4}$	264	12	$7\frac{1}{4}$	674	18	$10\frac{1}{4}$
6.	498	18	$10\frac{3}{4}$	893	16	$9\frac{3}{4}$	278	15	$7\frac{3}{4}$	697	14	$8\frac{1}{4}$
7.	637	14	$4\frac{1}{2}$	5874	13	$8\frac{1}{2}$	896	17	$3\frac{1}{2}$	876	12	$9\frac{3}{4}$
8.	926	17	$8\frac{1}{2}$	694	14	$10\frac{1}{2}$	986	14	$7\frac{1}{2}$	769	17	$7\frac{1}{2}$
9.	974	18	$7\frac{3}{4}$	9876	14	$5\frac{1}{2}$	248	14	$8\frac{1}{2}$	936	19	$9\frac{1}{2}$
10.	687	15	$8\frac{1}{2}$	876	18	$10\frac{1}{2}$	423	17	$9\frac{3}{4}$	674	12	$8\frac{3}{4}$

(2)

	(*a*)				(*b*)				(*c*)			
	tons.	cwt.	qr.	lb.	tons.	cwt.	qr.	lb.	tons.	cwt.	qr.	lb.
1.	5	10	2	12	6	5	3	11	8	17	3	12
2.	7	13	1	18	9	16	1	21	6	14	1	15
3.	12	9	2	5	7	13	3	18	8	14	2	19
4.	13	17	1	18	6	12	2	15	14	13	1	21
5.	17	13	2	14	9	14	0	21	6	13	0	15
6.	19	14	3	24	14	15	1	17	17	15	3	18
7.	13	15	1	21	16	18	2	26	14	17	2	19
8.	14	13	3	25	17	6	1	24	15	18	2	16
9.	15	14	1	26	18	13	3	17	14	9	1	6
10.	15	16	2	14	12	14	3	8	18	3	2	7
11.	14	6	1	15	6	16	1	21	9	15	1	18
12.	9	17	0	18	7	3	2	17	4	18	2	21

(3) What is the value of **12** pieces of cloth, each **60** yd. long, at **6**s. **3**d. per yd.?

(4) Find the area of a piece of ground **16·36** metres long and **7·5** metres wide.

(5) A post-card is $3\frac{1}{2}$ in. long and $2\frac{1}{2}$ in. wide. It is allowable to write on all one side and half the other. What space can be written upon in a packet of **12** such cards?

(6) A corn merchant bought **24** score lb. of oatmeal at $1\frac{1}{2}$d. per lb., and sold it at **2**s. **4**d. per stone. What did he gain?

(7) Make up a sum about the coal used in your home for **1** year, and work it.

Exercise 47.—Application of Previous Rules—II.

(1) A merchant bought **100000** lb. of wool. He received **6** bales weighing respectively **6** cwt. **2** qr. **18** lb., **7** cwt. **1** qr. **15** lb., **5** cwt. **3** qr. **12** lb., **8** cwt. **1** qr. **15** lb., **4** cwt. **3** qr. **15** lb., and **7**½ cwt. How many lb. had he still to get?

(2) How many flagstones each **3** ft. long and **2** ft. wide are needed for a causeway **250** yd. long and **3** yd. wide?

(3) What is the area of a piece of lead weighing **3** tons, if **1** sq. ft. of the same thickness weighs **12** lb.?

(4) Make out this bill for decorating a house: **43** lb. of paint at **5**½d. per lb.; **5** pt. of varnish at **12**s. per gal.; **18** rolls of paper at **9**½d. per roll; **45** hours' work at **9**½d. per hour.

(5) The time for work at a mill is **6** A.M. to **8** A.M.; **8.30** A.M. to **12.30** P.M.; **1.15** P.M. to **5.45** P.M. How many hours will **50** men work in all in **5**½ days?

(6) On an average, **1**½ pecks of potatoes are got from a sq. yd. of ground. How many quarters are got from a piece of ground measuring **6** chains by **4** chains?

(7) In the north of England a gill is reckoned as half-a-pint. How many gill-bottles can be filled with olive-oil out of a cask containing **36** gallons?

(8) A mason is paid **9**d. per hour. What is the weekly wage bill for **240** masons if they work **54** hours per week? (*Work in the shortest way.*)

(9) Granite sets are **30**s. **0**d. per ton. If a ton will pave **2** sq. yd., what is the cost of sets to pave a street **12** yd. wide and **70** yd. long?

(10) A tea merchant bought **2000** lb. of tea at **11**½d. per lb., and paid **5**d. per lb. duty. If he sold it at **1**s. **9**d. per lb., what profit did he get?

(11) Find the cost of **48** yd. of silk, if **6** yards cost **£1**, **13**s. **0**d.

(12) What is the total weight of **350** bales of wool, each weighing **5** cwt. **2** qr. **14** lb.?

(13) Turnips are sold at **£1**, **5**s. **0**d. per ton. If a farmer gets on an average **25** tons per acre from **10** acres, what is the value of his crop?

(14) A spring requires **5** yd. **1** ft. **6** in. of wire. How many such springs can be made from a mile of wire?

(15) If your father earns **36**s. **0**d. per week and saves **4**s. **0**d., show how the rest of the money might be spent.

Exercise 48.—Percentages.

(1) On squared paper show 3 per cent.; 6 per cent.; 5 per cent.; 10 per cent.

(2) Draw a square $2\frac{1}{2}''$ each side, and divide it into 100 equal squares. On this show 2 per cent.; 4 per cent.; 8 per cent.; 10 per cent.; 15 per cent.

(3) Write down the percentage in these cases: 15 sheep out of 100 sheep; 24 boys out of 300 boys; £18 out of £300; 5 marbles out of 50 marbles; 4 books out of 25 books; 7 hens out of 50 hens; 12 pigs out of 200 pigs; 36 lambs out of 600 lambs.

(4) Write the following as vulgar fractions: 10 per cent.; 15 per cent.; 18 per cent.; 25 per cent.; 14 per cent.; 12 per cent.; 50 per cent.; 16 per cent.; 32 per cent.

(5) What per cent. do the following fractions represent: $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{5}$; $\frac{2}{5}$; $\frac{3}{10}$; $\frac{7}{10}$; $\frac{3}{4}$; $\frac{4}{5}$; $\frac{3}{20}$; $\frac{7}{20}$; $\frac{4}{25}$; $\frac{6}{25}$; $\frac{8}{25}$?

(6) What is 5 per cent. of £20? of £50? of £200?

(7) What is 3 per cent. of 5 tons? 4 per cent. of 5 tons? 6 per cent. of 5 tons? 10 per cent. of 5 tons? 15 per cent. of 5 tons? 50 per cent. of 5 tons?

(8) What is 4 per cent. of £400? 8 per cent. of £500? 12 per cent. of £300? 15 per cent. of 500 men? 18 per cent. of 200 men? 16 per cent. of 300 boys?

(9) A farmer had 400 sheep, and he sold 20 per cent. of them. How many sheep had he then?

(10) A merchant bought 600 lb. of wool, but 5 per cent. was spoiled by water. How many lb. were spoiled?

(11) A grocer bought a box containing 600 eggs. There were 36 broken ones. What was that per cent.?

(12) If 20 lb. of oatmeal was spoiled out of 20 score lb., what was that per cent.?

(13) A man earns £2, 10s. per week and saves 6s. 0d. What does he save per cent.?

(14) Make up a sum about the percentage of boys absent in your class.

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(15) Multiply together the sum and difference of $\frac{2}{3}$ and $\frac{1}{2}$.

(16) A field is 5·4 metres long and 3·6 metres wide. What is its area?

Exercise 49.—Interest.

Learn:

$2\frac{1}{2}$ % of £1 = 6d.
5 % of £1 = 1s. 0d.

Always show the working clearly—e.g.:

What is the interest on £300 for 2 years at £4 per cent. per annum?

Interest on £100 for 1 year = £4. Or, Interest on £100 for 1 year = £4.

" £1 for 1 year = $£\frac{4}{100}$. " £300 for 1 year = £4 × 3.

" £300 for 1 year = $£\frac{4 \times 300}{100}$. " £300 for 2 years = £4 × 3 × 2 = £24.

" £300 for 2 years = $£\frac{4 \times 300 \times 2}{100}$ = £24.

(1) What is the interest for 1 yr. at £5 per cent. on £300? on £400? on £500? on £250? on £450?

(2) What is the interest for 2 yr. at £4 per cent. per annum on £200? on £150? on £350? on £475?

(3) Find the simple interest on: (*a*) £600 for 1 yr. at £3 per cent.; (*b*) £300 for 2 yr. at £4 per cent. per annum; (*c*) £450 for 2 yr. at £5 per cent. per annum.

(4) How much is the simple interest on: (*a*) £50 for 1 yr. at £3 per cent.? (*b*) £75 for 2 yr. at £4 per cent. per annum? (*c*) £175 for 3 yr. at £3 per cent. per annum?

(5) If £3 per cent. is paid for the loan of £100 for 1 year, how much is paid for 6 months? for 3 months? for 9 months? for 4 months? for 1 month? for $2\frac{1}{2}$ yr.? for 3 yr. 4 months? for 1 yr. 9 months?

(6) Write down the fractions, both vulgar and decimal, for the following: £5 per cent.; £3 per cent.; £$2\frac{1}{2}$ per cent.; £6 per cent.

(7) Find the simple interest on: (*a*) £400 for 3 yr. at £3 per cent. per annum; (*b*) £500 for 4 yr. at £2 per cent. per annum; (*c*) £450 for $2\frac{1}{2}$ yr. at £4 per cent. per annum; (*d*) £75 for 4 yr. at £5 per cent. per annum; (*e*) £300 for 6 mo. at £3 per cent. per annum; (*f*) £250 for 9 mo. at £4 per cent. per annum.

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(8) In a class of 50 boys there were 48 present. What percentage was absent? What percentage was at school?

(9) Calculate the cost of 500 tons of coal at 17s. 6d. per ton.

(10) Make up a sum about the interest on the money you have in the savings bank.

Exercise 50.—Short Methods.

(1) What is the sum of **444**, **356**, **444**, **356**, **444**, **356**, and **1000**?

(2) How much is paid for **2000** tons of best coal at £**1**, **0**s. **6**d. per ton?

(3) What is the difference in cost between **36** doz. yd. of calico at **5**$\frac{1}{4}$d. per yd. and **36** doz. yd. of flannel at **6**$\frac{3}{4}$d. per yd.?

(4) If a man spends on an average **9**d. every day in travelling, what are his travelling expenses for a year?

(5) In a month a grocer sold **720** eggs. If he bought them at **9** for a shilling and sold them at **8** for a shilling, what profit did he make?

(6) What is the difference in cost between **100** barrels of Newtown apples at **19**s. **10**d. per barrel and **100** barrels of Northern Spies at £**1**, **0**s. **10**d. per barrel?

(7) What is the interest on £**650** for **2** years at **5** per cent. per annum?

(8) Find the cost of **48** score lb. of oatmeal at **1**$\frac{3}{4}$d. per lb.

(9) What is the total length of **200** plant-sticks, each measuring **1·85** metres?

(10) Work in the shortest way: (*a*) 649×99; (*b*) 649×101; (*c*) 376×25; (*d*) 664×125.

(11) A grocer bought **1000** eggs, and found that **60** were broken. What percentage of broken eggs was there?

(12) Without working, say if the following are correct or not. Give a reason for your answer in each case.

(*a*) £**5**, **16**s. **9**$\frac{1}{2}$d. $\times 240 =$ £**1401**, **9**s. **9**$\frac{1}{2}$d.;
(*b*) **31·26** metres $\times 200 =$ **625·2** metres;
(*c*) $27 \div 5 = 5{\cdot}4$.

(13) Find the cost of **500** lb. of cheese at £**2**, **11**s. **4**d. per cwt. What is the price of the cheese per lb.?

(14) How would you find the cost of **49** spades at **2**s. **9**d. each?

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(15) A boy lives $\frac{3}{4}$ mile from school. If his step is $\frac{5}{8}$ yd. long, how many steps will he take in going to and from school?

(16) What is the value of £**·625** + **1·75** of **10**s. **0**d. + **·125**s. of a crown?

(17) Give £**1**, **14**s. **6**d. as the fraction of **5** guineas.

Exercise 51.—Geometrical Construction.

(1) From a piece of gummed paper cut out a square, and make it into a rhombus.

(2) Cut out an oblong from gummed paper, and make it into a parallelogram.

(3) Draw a parallelogram with base **7** cm., sides **5** cm., and angle **70°**. From the angle over the base draw a line at right angles to the base. Show that the area of the parallelogram is that of an oblong having the same height.

(4) From the above figure, show how to find the area of a triangle. What is the relation between the areas of a triangle and a parallelogram on the same base and having the same height?

(5) When is a parallelogram called a square? a rectangle? a rhombus?

(6) Find the area of parallelograms with the following dimensions:

(*a*) base **6** in.; height **5** in. (*b*) base **7** in.; height **4** ft.
(*c*) " **3** ft. **6** in.; " **2** ft. (*d*) " **12** cm.; " **9** cm.
(*e*) " **1·2** dm.; " **9** cm. (*f*) " **1·6** m.; " **1·3** m.

(7) Find the area of triangles having the following dimensions:

(*a*)	base **3** ft.;	altitude **2** ft.
(*b*)	" **3** yd. **1** ft.;	" **4** yd.
(*c*)	" **2** ft. **6** in.;	" **3** ft. **6** in.
(*d*)	" **15** cm.;	" **12** cm.
(*e*)	" **2·4** dm.;	" **2·6** dm.
(*f*)	" **3·5** m.;	" **2** m.
(*g*)	" **2·3** m.;	" **1·6** m.
(*h*)	" **3·12** m.;	" **2·4** m.
(*i*)	" **3** yd. **1** ft. **6** in.;	" **2** yd.
(*j*)	" $2\frac{3}{4}$ yd.;	" $1\frac{7}{8}$ yd.

(8) A dog-kennel is **4** ft. **6** in. wide, **3** ft. high to the eaves, and **5** ft. high to the ridge of the roof. Find the area of one end.

(9) What is the area of both ends of the kennel in question (8), omitting the doorway, which is **2** ft. **6** in. high and **2** ft. wide?

(10) A haystack is **5** yd. wide, **6** yd. high to the eaves, and **9** yd. to the ridge. What is the area of both ends?

(11) A map is made to a scale of **6** in. to one mile. What area does it represent if it is **4** ft. **6** in. long and **4** ft. wide?

Exercise 52.—Proportion.

(1) A piece of bacon weighing **5** lb. cost **4**s. **9**½d. How much is a piece weighing **4** stones worth?

(2) A merchant has **8** rolls of cloth, each measuring **56** yd. He sells it in lengths of **8** yd. for **31**s. **4**d. What will he get for the whole?

(3) A grocer receives **5** boxes of eggs, each holding **3** gross. How much will he get for them at **18** for **1**s. **3**d.?

(4) Two classes, each consisting of **50** boys, are being supplied with reading-books. If the books cost **15**s. **6**d. a dozen, what will be the total cost?

(5) A farmer sells his turnips at £**1**, **5**s. **0**d. per ton. How much will he get for **3** loads of turnips, each consisting of **12** cwt. **2** qr.?

(6) A man buys **25** brooms at a guinea a dozen, and **15** garden spades at **4** for **11**s. **0**d. What amount does he pay?

(7) A railway ticket for a journey of **70** miles costs **3**s. **6**d. How much will it cost **27** men to go a distance of **50** miles?

(8) Half-a-stone of nails cost **1**s. **5**d. What will be the cost of **2** cwt. **3** qr. **7** lb.?

(9) A greengrocer buys tomatoes at **5** lb. for **1**s. **10**½d. How much must he sell **43** lb. for so as to gain **2**d. per lb.?

(10) The total cost of **3** loads of coal, each containing **1** ton **1** cwt. **2** qr., is £**3**, **4**s. **6**d. What should a bag containing **1** cwt. be sold for?

(11) One train travels at the rate of **39** miles an hour, and another at **42** miles an hour. How much farther will one go than the other in **10** minutes?

(12) A mill uses **77** tons **11** cwt. of coal in **5**½ days. How much coal is used in **90** days?

(13) How much tea at **2**s. **3**d. per lb. should be exchanged for **2** cwt. **46** lb. of sugar at **2**½d. per lb.?

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(14) A pole is $\frac{1}{5}$ in the mud, $\frac{1}{3}$ in the water, and **7** feet is above the water. How long is the pole?

(15) It is **14** yd. **2** ft. round a circular tank. How far is it across?

(16) A boy sleeps from **8.30** P.M. to **7.15** A.M. What fraction of a day does he sleep?

(17) Rope is sold at **3**$\frac{3}{8}$d. per yard. What is the value of a rope **2** chains long?

Exercise 53.—Miscellaneous Exercises.

(1) A haystack is 10 yd. long, 8 yd. wide, 6 yd. high to the beginning of the slope, and 9 yd. high to the ridge. Make a sketch of one end, and find its area.

(2) A coal-train consisted of 45 trucks. If each truck weighed 2 tons 16 cwt. 3 qr., and contained 8 tons 14 cwt. of coal, what weight had the engine to pull?

(3) Find the value of £2·65 + £3·275 + £5·425. (*Give your answer in £, s. d.*)

(4) A joiner earned 9½d. per hour, and worked 54 hours per week. If he paid £14, 6s. 0d. per year for rent, how much of his wages had he left?

(5) A game-dealer bought 150 turkeys at an average cost of 6s. 9d. each, and 90 geese at 5s. 5d. each. What did he pay for them?

(6) A school is opened 9 times in one week. The attendances were 239, 239, 241, 250, 245, 237, 244, 235, and 230. Find the average attendance.

(7) 25 per cent. of the boys in a school is 85. How many boys are there in the school?

(8) How many slices of bread, each ·4 in. thick, can be cut from 6 loaves, each 7·8 in. long?

(9) A grocer bought 5 tons 15 cwt. of cheese at £4, 15s. 0d. per cwt. What did it cost him? (*Work the sum by vulgar fractions and then by decimals.*)

(10) What is the area of a field 6 chains 11 yd. long and 4 chains 11 yd. wide?

(11) A room is 16 ft. long and 14 ft. wide. All round there is a border of oilcloth 2 ft. wide. What is the cost of the oilcloth at 4s. 6d. per sq. yd.?

(12) There were 1200 passengers on board an American liner. If $\frac{1}{8}$ went first-class, and $\frac{1}{5}$ went second-class, how many passengers went third-class?

(13) Find the difference between the least and the greatest of the following: $2\frac{1}{3}$, $3\frac{1}{5}$, $2\frac{3}{8}$, $3\frac{1}{4}$.

(14) Find the least number exactly containing 14, 21, 28.

(15) A trench is a yd. long, b yd. wide, and c yd. deep. Find how much earth has been removed.

(16) Make up a sum about anything connected with your clothing.

Exercise 54.—Symbolic Arithmetic.

(1) Work the following:

(*a*) $64x+21x-32x$; (*b*) $\frac{a}{4}+\frac{a}{3}$;

(*c*) $4(p-3)+3(p-5)$; (*d*) $5(x+6)+4(x-5)$;

(*e*) $2b+3(c-4)$; (*f*) $7(m-6)+24m$.

(2) Find the value of x in the following:

(*a*) $4x+6=3x+9$; (*b*) $6x-5=3x+10$;

(*c*) $3(x+4)=2(x+7)$; (*d*) $5(x-6)=3(x+10)$;

(*e*) $4(x+12)=3(x+16)$; (*f*) $x+4=\frac{x}{2}+10$.

(3) A boy had **12** shillings in his money-box. He bought a toy engine for x shillings, and his mother gave him y shillings. How much had he then?

(4) A man ordered **16** sacks of flour, each to contain x stones. He found that each sack was **1** stone short. How many stones did he get?

(5) A boy said, 'Yesterday I had **48** marbles. I lost x marbles this morning, and have **27** left.' Show how many he had lost.

(6) If x stands for a certain number, what are the next three numbers above x? the next three numbers below x?

(7) A sheet of paper is x in. wide and **7** inches long. What is the area of two such sheets?

(8) A box is x inches long and y inches wide. What is the combined area of the top and bottom?

(9) Two boys had x pence each. One boy spent **6**d., and then the other boy had twice as much as he had. How much had each at first?

(10) The ages of a father and son added together are **56** years. If the father is **3** times as old as his son, what are their ages?

(11) In a box there are x coins. There are **10** florins, **8** shillings, **8** sixpences, and the rest are pennies. How many pennies are there?

(12) A and B have £**22** between them. If A earns £**2** more, he will have twice as much as B. How much has each at present?

(13) Make up a sum about x boys in a class.

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(14) How many half-pound parcels can be made from five chests of tea, each of which contains **1**$\frac{1}{4}$ cwt.?

Exercise 55.—Cubic Measure—I.

(1) Make a sketch of a box 5 in. long, 4 in. wide, and 3 in. high.

(2) Find the volume of pieces of wood of these dimensions:
(*a*) 9 in. long, 3 in. wide, and 2 in. thick;
(*b*) 1 ft. 4 in. long, 9 in. wide, and 2 in. thick;
(*c*) 6 ft. 6 in. long, 9 in. wide, and 3 in. thick;
(*d*) 15 ft. long, 11 in. wide, and 4 in. thick;
(*e*) 8 ft. long, 2 ft. 6 in. wide, and 2 ft. 1 in. thick.

(3) A schoolroom is 18 yd. long, 12 yd. wide, and 8 yd. high. How many cubic yards of air does it contain?

(4) If 1 cubic yard is reckoned as a cart-load, how many times will a cart be filled from a trench 20 yd. long, 2 yd. wide, and 1 yd. deep?

(5) The top of a box is 4 feet square, and it is 3 ft. high. How many such boxes can be packed into a cellar 12 yd. square and 3 yd. high?

(6) A piece of wood is 6 dm. long and 8 cm. square. How many cubic centimetres are there in it?

(7) A garden-plot is 10 yd. long and 4 yd. wide. If it is to be covered with soil 1 ft. thick, how many cubic feet of soil will be required?

(8) A box is 4 ft. long, 3 ft. wide, and 2 ft. high. How many boxes 6 in. long, 3 in. wide, and 3 in. high can be packed into it?

(9) A cubic decimetre of water is a litre. How many litres will a tank hold which is 1 metre long, 9 dm. wide, and 6 dm. in depth?

(10) A block of peat-moss is 4 ft. long, 2 ft. wide, and 2 ft. thick. How many cubic feet are there in a load of 12 blocks?

(11) If each block in question (10) weighs 2 cwt., and they are all placed on a wagon, what is the weight pulled by the horse if the empty wagon weighs 1 ton 4 cwt. 2 qr.?

(12) A bale of wool is 1 yd. long and 2 ft. square. What space is filled by 48 such bales?

(13) On a wagon there are 36 empty cases, each measuring 3 ft. by 2 ft. by 1 ft. 6 in. What space do they occupy?

(14) Make up a sum about the space taken up by the cupboard in your class-room.

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(15) (*a*) $32{\cdot}6 \times 67{\cdot}8$; (*b*) $(1\frac{2}{3}+1\frac{1}{2})-(1\frac{3}{5}+1\frac{1}{3})$.

Exercise 56.—Cubic Measure—II.

(1) A brick is **9** in. long, **4** in. wide, and **3** in. thick. How many cubic feet are there in a load of **300** bricks?

(2) A cubic ft. of water weighs $62\frac{1}{2}$ lb. On 1st Nov. 1913 half an inch of rain fell in the school garden. How many lb. of rain fell on a plot **10** yd. long and **5** yd. wide?

(3) A block of wood is **2** ft. long and **3** ft. square. In how many different ways could you cut it into a number of equal pieces **1** in. thick?

(4) In the woodwork room there is a pile of **50** pieces of wood, each **15** in. long, **3** in. wide, and **2** in. thick. How many cubic feet and cubic inches are there in it?

(5) A block of wood **3** ft. long, **8** in. wide, and **4** in. thick is cut into boards **1** in. thick. Make a sketch of what the block is like when cut up.

(6) If **2** in. = **5** cm., how many cubic cm. are there in a block of wood **2** ft. long, **6** in. wide, and **4** in. high?

(7) Find the volume of **12** pieces of wood, each a in. long, b in. wide, and c in. thick.

(8) A cubic ft. of ice weighs **57** lb. What is the weight of a block **3** ft. long, **2** ft. wide, and **1** ft. **6** in. thick?

(9) A parcel of paper is **1** ft. **9** in. long, **1** ft. **6** in. wide, and **6** in. thick. What is the volume of a pile containing **24** such parcels?

(10) How many bricks **9** in. long, $4\frac{1}{2}$ in. wide, and **3** in. thick are there in a pile **9** ft. long, **9** ft. wide, and **6** ft. high?

(11) It costs **1**s. **6**d. to cart away a load of earth. What is the cost of carting for a cellar **15** ft. long, **12** ft. wide, and **9** ft. deep, if a cubic yard of earth forms a load?

(12) Reduce to cubic inches: (*a*) **2** cubic yd.; (*b*) **4** cubic ft. **500** cubic in.; (*c*) **1** cubic yd. **6** cubic ft. **150** cubic in.; (*d*) **3** cubic yd. **4** cubic ft. **95** cubic in.

(13) A garden is **24** yd. long and **15** yd. wide. It is covered with snow **4** in. thick. How many cubic ft. of snow are there in the garden?

(14) Make up a sum about the number of cubic ft. of air in your bedroom.

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(15) What is the value of **50** planks, each **18** ft. long and **9** in. wide, at **3**d. per sq. ft.?

(16) Find the surface of a cube whose edge is **1** ft. **6** in.

Exercise 57.—Square Measure.

(1) Draw a figure to show **1** acre on the scale $\frac{1}{2}'' = 1$ chain.

(2) Write down the number of square yd. in a square chain; and find how many square chains there are in **2** acres.

(3) Find the number of acres there are in a field **400** yd. long and **242** yd. wide.

(4) What is the area in acres and sq. yd. of a piece of land **340** yd. long and **220** yd. wide?

(5) How many bushels of oats are needed to sow a field **15** chains long and **12** chains wide, if **3** bushels are needed per acre?

(6) A farmer gets **15** tons of turnips per acre. Find the number of tons in a field **15** chains long and **9** chains wide.

(7) The rent of a farm is £2, 10s. per acre. What is the rent of a field **12** chains long and **8** chains wide?

(8) In a field **74** chains long and **10** chains wide, $\frac{1}{3}$ is sown with wheat, $\frac{1}{4}$ with oats, and the rest with turnips. How many square chains are sown with turnips?

(9) Side by side are two bowling-greens, each **40** yd. square. How many sq. yards short of an acre do they occupy?

(10) Reduce **2** acres **5** sq. chains to sq. yd.; **3** acres **6** sq. chains **200** sq. yd. to sq. yd.

(11) If a metre = **39·4** in., find the difference (in sq. inches) between a sq. yard and a sq. metre.

(12) A field contains **3** acres. If it is **242** yd. long, how wide is it?

(13) In a parcel there are **500** right-angled triangular flags. If each is **7** in. high and **4** in. wide, how many sq. yards, &c., will all the flags cover?

(14) How many sq. yd. are there in x acres?

(15) Write down a sum about the area of the field nearest to your school.

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(16) Find the cost of digging a cellar **6** yd. long, **15** feet wide, and **9** feet deep, at **1**s. **6**d. per cubic yd.

(17) After spending $\frac{2}{5}$ of a sum of money, a man found that $\frac{1}{3}$ of the remainder was **10**s. **0**d. What sum was there at first?

Exercise 58.—Trade Accounts.

(1) In a year a firm used **25** tons **10** cwt. of tallow at £**1**, **14**s. **6**d. per ton. Find, using decimals, the total cost.

(2) A grocer bought **1** ton **5** cwt. of raisins at **4**½d. per lb. He had **2** cwt. of waste. What profit did he make if he sold the remainder at **7**d. per lb.?

(3) Floor-boards cost **1**s. **2**d. per sq. yd., and joiners' wages are **9**d. per hour. What does it cost to lay a floor **36** feet long and **24** feet wide, if it takes **3** joiners **4** days of **9** hours each?

(4) A farmer used **4** tons **15** cwt. of bone-meal at £**6**, **15**s. per ton, and **3** tons **5** cwt. of nitrate of soda at £**7**, **15**s. per ton. What was paid for these?

(5) A **4**-oz. tin of cocoa cost **7**½d. Find the value of **3** cwt. **2** qr. of cocoa.

(6) The following is a copy of a butcher's bill: **5** lb. **4** oz. of beef cost **4**s. **4**½d.; leg of mutton weighing **9**½ lb. cost **8**s. **8**½d.; **6** lb. **8** oz. of pork cost **5**s. **11**½d. Find the price per lb. in each case.

(7) What is the value of **16** chests of tea, each weighing **3** qr. **14** lb., at **1**s. **8**½d. per lb.?

(8) Bricks are **42**s. per **1000**. It took **200000** bricks to build a chimney. If other expenses were £**475**, what did the chimney cost?

(9) In dyeing, a piece shrinks **4** yd. A merchant sent **100** pieces, each **40** yd. long, to dye. They cost him £**800**, and he sold them at **6**s. **6**d. per yd. If he paid £**200** for dyeing, what profit did he make?

(10) The price of yarn rose from **2**s. **11**d. per lb. to **3**s. **3**d. per lb. If a manufacturer bought **1000** lb. at the cheaper price, how much did he save?

(11) What does it cost to fence a field **240** yd. long and **140** yd. wide at **3**s. **4**d. per yd., if the labour is one-tenth the cost of the material?

(12) **2000** lb. of wool cost £**266**, **13**s. **4**d. What was the price per lb.?

(13) Make up a sum about a grocer buying cheese for Christmas, and work it.

(14) Find the cost of **4560** tons of granite sets at £**1**, **15**s. **0**d. per ton.

Exercise 59.—Vulgar and Decimal Fractions.

(1) State in one line, and then work each of the following:
   (*a*) Add together $\frac{1}{3}$, $\frac{3}{4}$, and $\frac{5}{6}$, and divide the answer by $4\frac{3}{5}$.
   (*b*) Divide the sum of $\frac{3}{5}$ and $\frac{2}{3}$ by their difference.
   (*c*) Multiply $1\frac{2}{3}$ by $\frac{3}{4}$, and take $\frac{5}{6}$ from the answer.
   (*d*) A sum of money is divided as follows: $\frac{1}{3}$ to the son, $\frac{1}{4}$ to each of two daughters, and the rest to a nephew. What part does the nephew get?

(2) In a school there are **180** pupils. $\frac{1}{3}$ come every time the school is open, $\frac{2}{5}$ miss once, and the rest more than once. How many miss more than once?

(3) A dealer bought $\frac{3}{4}$ of a stack of hay. He sold half of what he bought for **£15**, 0s. 0d., and $\frac{1}{3}$ of what he bought for **£9**. How much of the stack had he left?

(4) At an entertainment there were **270** persons. $\frac{2}{3}$ of these were women, $\frac{1}{6}$ were men, and the rest were children. How many children were there?

(5) Work the following by both vulgar and decimal fractions:
   (*a*) Find the cost of **5** tons **12** cwt. of iron at **£4**, **17**s. **6**d. per ton.
   (*b*) A tile is **6** in. square. How many are required for a passage **5** yd. **1** ft. **6** in. long and **2** yd. **1** ft. **6** in. wide?
   (*c*) The carcass of a pig weighs **21** stones. If it is **8**s. **9**d. per stone, what will a man pay for half of it?
   (*d*) A field **16** chains long and **12** chains wide yields on an average **15** tons **5** cwt. of turnips per sq. chain. What weight is got from the field?

(6) The rainfall for **6** months was **2·65** in., **1·26** in., **3·17** in., **0·87** in., **1·64** in., and **1·53** in. What was the average for the six months?

(7) A farmer hatched **250** turkeys. **·2** of them died in the first week, **·1** were killed by foxes, and he sold **·5**. How many had he then?

(8) What is the value of **25·75** tons of coal at **£1**, 2s. 6d. per ton?

(9) Find the area of a piece of land **74·6** m. long and **56·4** m. wide.

(10) Make up a sum, employing both vulgar and decimal fractions, about the boys in your class.

(11) Add together $\frac{3}{8}$ of **15**s. 0d., $\frac{2}{3}$ of $2\frac{1}{2}$ guineas, and $\frac{3}{5}$ of half-a-crown.

Exercise 60.—Application of Cubic Measure.

(1) Find the cubic contents of pieces of wood of these dimensions:
   (*a*) 11 ft. long, 11 in. wide, and 3 in. thick.
   (*b*) A plank 12 ft. long, 9 in. wide, and 3 in. thick.
   (*c*) A log of mahogany 9 ft. long and 1 ft. 8 in. square.
   (*d*) A piece of oak 4 yd. long and $2\frac{1}{2}$ ft. square.

(2) A cellar is 18 ft. long, 10 ft. wide, and 9 ft. deep. What did it cost to make at 2s. 3d. per cubic ft.?

(3) A cubic yd. of earth is a cart-load. If a man is paid 1s. 6d. for each load, what does he earn by carting away the earth from a trench 20 yd. long, 9 ft. wide, and 6 ft. deep?

(4) A street is 60 yd. long and 12 yd. wide. It is covered with granite sets 6 in. thick. If a cubic ft. of granite weighs 168 lb., how many tons of granite are there in the street?

(5) A cubic ft. of snow weighs 10 lb. If the snow in the school garden is 6 in. thick, what weight (in lb.) is there on 12 plots, each 12 yd. long and 4 ft. wide?

(6) A cubic ft. of water weighs 1000 oz. How many lb. of water will a tank hold which measures 12 ft. by 8 ft. by 4 ft.?

(7) A cubic ft. of water weighs $62\frac{1}{2}$ lb. On 6th Nov. 1913, ·5 in. of rain fell in 4 hours. What weight of water (in lb.) fell on a field 120 yd. long and 90 yd. wide?

(8) A brick is 9 in. long, $4\frac{1}{2}$ in. wide, and 3 in. thick. How many bricks are there in a pile 15 ft. long, 12 ft. wide, and 6 ft. high?

(9) A piece of soap is 6 in. long, 3 in. wide, and 2 in. thick. How many pieces can be packed into a box 2 ft. long and 1 ft. 6 in. square?

(10) A schoolroom is x ft. long, y ft. wide, and z ft. deep. What space is there in the room?

(11) Make up a sum about the cubic contents of a box you have seen in a grocer's shop.

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(12) If 58 sheep cost £137, 15s. 0d., find the price of 16.

(13) Four boards are 12 ft. 8 in., 10 ft. 9 in., 11 ft. 4 in., and 8 ft. 9 in. long. What is the average length?

(14) What number multiplied by 57 will give the same product as 247 multiplied by 21?

(1) Without any figuring, write down the answers to the following:

(*a*) Bring **26·25** francs to centimes.
(*b*) " **234·75** " "
(*c*) " **826·49** " "
(*d*) " **3647** centimes to francs.
(*e*) " **26748** " "

(2) What is the value of a tub of butter containing **25** Kg. at **2·55** francs per Kg.?

(3) Cloth cost **7·25** francs per metre. What is the value of the cloth for a suit if it takes **3·5** metres?

(4) A French newspaper costs **10** centimes. What does a Frenchman pay for daily papers in a year, omitting Sundays?

(5) Calico is ·**75** fr. per metre. What is the value of a piece containing **60** metres?

(6) A certain French wine costs **150** centimes per litre. What is the value of **10** Kl.?

(7) If a franc is worth **9½**d., how many francs should an Englishman get for **£5**, **18**s. **9**d.?

(8) Find the value of **450** fr. in English money, if a franc is worth **9½**d.

(9) Reckoning **25** francs to a sovereign, what is the value of a cheque for **377** fr. **50** c.?

(10) In America a certain cloth costs **3** dollars **25** cents per yd. What must be paid for a suit-length of **3½** yd.?

(11) An English merchant bought **350** bushels of wheat at **4·25** dollars per bushel. How much did he pay for it?

(12) If the wages of a man are **$2·75** for each working-day, how much will he earn in a year?

(13) What is the value of **$450**, if a dollar is worth **4**s. **2**d.?

(14) An Englishman took **£250** with him to America, and changed it into dollars. How many did he get?

(15) A family in America used **1** qt. of milk per day, which cost **8** cents. What was the milk bill for **1** year?

(16) Make up a sum about an American boy buying a football, if he had **$5** in his pocket.

(17) Find the cost of **568** Kg. of hay at **10** centimes a Kg.

Exercise 62.—Revision and Extension of Former Rules.

(1) What does a merchant pay for **12** cases of eggs, each containing **750**, at **6**s. **3**d. per **100**?

(2) A standard of boards contained **420** sq. yd., and a standard of planks **160** sq. yd. Find the total cost, if the boards cost **11**$\frac{1}{2}$d. a sq. yd. and the planks **1**s. **9**d. a sq. yd.

(3) A street **50** yd. long and **12** yd. wide is paved with wooden blocks, each **6** in. long and **3** in. wide. How many blocks were needed?

(4) The end of a mill is **12** yd. wide, **18** yd. high to the eaves, and **24** yd. to the ridge. What is the area of the end?

(5) Divide the sum of $1\frac{3}{4}$ and $2\frac{1}{3}$ by their difference.

(6) A butcher started with **40** stones of beef. He sold $\frac{3}{5}$ on Friday morning, $\frac{1}{4}$ on Friday afternoon, and $\frac{1}{10}$ on Saturday. How much had he left?

(7) Multiply the sum of **2·9** in. and **3·8** in. by **7·6**.

(8) A piece of land is **18·4** metres long and **12·7** metres wide. What is the area?

(9) How often can a piece of string **7·2** dm. long be cut from **5·184** Hm.?

(10) Six boards were the following lengths: **5** yd. **2** ft. **6** in., **2** yd. **1** ft. **8** in., **4** yd. **10** in., **5** yd. **1** ft. **8** in., **3** yd. **2** ft. **6** in., and **6** yd. **1** ft. What was the average length?

(11) The total weight of **6** boys was **171** Kg. One boy weighed **31·5** Kg. What was the average weight of the others?

(12) What is the interest on £**550** for **3** years at **4** $\%$ per annum?

(13) A man borrowed £**350** for **3** years at **5** $\%$ per annum. How much would he have to pay back at the end of that time?

(14) In a school there were **350** boys. If **4** per cent. were away through illness, how many were present?

(15) In a box there were **450** eggs. If **27** were broken, what percentage were good ones?

(16) **12** stones of oats cost **15**s. **0**d. What is the cost of **54** stones at the same rate?

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(17) A train goes **66** ft. per second, and completes a journey in **15** min. What is the distance?

(18) If $\frac{5}{8}$ of a mill is worth £**6725**, what is half the mill worth?

Exercise 63.—Bills.

Make out and receipt the following bills:

(1) A leg of mutton weighing 11 lb. at 10½d. per lb.; a hind-quarter of pork weighing 15 lb. at 9½d. per lb.; a loin of veal weighing 20 lb. at 11d. per lb.; a leg of lamb weighing 6½ lb. at 11½d. per lb.

(2) 4 doz. ducks at 5s. 6d. per couple; 60 chickens at 3s. 3d. each; 86 geese at 5s. 3d. each; 8 turkeys at 11s. 8d. each.

(3) 4 doz. boys' caps at 11½d. each; 9 umbrellas at 8s. 9d. each; 6½ doz collars at 6½d. each; 2 doz. ties at 3 for 2s. 6d.; 9 pocket-handkerchiefs at 8s. 0d. per doz.

(4) 1 gross of lead-pencils at 6½d. per doz.; 20 quires of paper at 3d. per quire; 18 bottles of ink at 8½d. per bottle; 1½ gross of exercise-books at 9d. per doz.; 20 quires of blotting-paper at 5½d. per quire.

(5) ½ cwt. of sugar at 2½d. per lb.; ¼ cwt. of tea at 1s. 10d. per lb.; 1½ st. of coffee at 1s. 8d. per lb.; 1 cwt. of rice at 3½d. per lb; 18 lb. of candles at 11d. per lb.

(6) 4 stones of apples at 3d. per lb.; 1 cwt. of potatoes at 7 lb. for 4½d.; 4 stones of onions at 3½ lb. for 8d.; 1¼ cwt. of tomatoes at 4½d. per lb.; 420 oranges at 4d. per doz.

(7) 1 gross packets of screws at 7d. per packet; ½ cwt. of nails at 7 lb. for 10d.; 1½ tons of lead at 17s. 6d. per cwt.; 5 doz. latches at 9½d. each; 6 tons of piping at 1s. 1d. per cwt.

(8) 6 cheeses, each weighing 15 lb., at 8d. per lb.; 2¾ gallons of cream at 7d. per pint; ½ cwt. of butter at 1s. 2d. per lb.; 40 gallons of milk at 3½d. per qt.

(9) 26 yd. of dress material at 2s. 11½d. per yd.; 11 yd. of silk velvet at 21s. 6d. per yd.; 7½ doz. yards of muslin at 8½d. per yd.; 25 pairs of stockings at 2s. 3d. per pair; 66 yd. of flannel at 1s. 2½d. per yd.

(10) 9 loads of gravel at 4s. 6d. per load; 200 celery-plants at 4d. per score; 8 cwt. of seed potatoes at 1s. 3d. per cwt.; 5½ doz. shrubs at 3s. 9d. per doz.; gardener's time, 21½ hours at 7d. per hour.

(11) Make out a grocer's bill for your family for 1 week, and work it.

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(12) A dealer bought a piano for £45, and sold it so as to gain £5. What percentage was that?

Exercise 64.—Proportion by Graphs.

Work the first 12 *questions by means of graphs:*

(1) 8 books cost 10s. 0d. Find the cost of 3 books; of 9 books; of 15 books; of 24 books.

(2) 4 lb. of tea cost 6s. 8d. Find the cost of 5 lb.; of 9 lb.; of 13 lb.; of 21 lb.; of 28 lb.

(3) If 6 shirts cost £2, what is the cost of 5 shirts? of 8 shirts? of 18 shirts?

(4) If 4 lb. of cheese cost 3s. 4d., find the cost of 10 lb.; of 15 lb.; of 5 lb.; of 26 lb.

(5) Eggs are 14 for 1s. 0d. How many can be bought for 8s.? for 12s.? for 15s. 6d.? for £1, 2s. 0d.?

(6) A cyclist goes 40 miles in 4 hr. How far should he go in 6 hr.? in 10 hr.? in 3 hr.? in $8\frac{1}{2}$ hr.?

(7) A machine can make 600 nails in 4 minutes. How many can it make in 6 min.? in 12 min.? in 30 min.?

(8) If 4 oz. of coffee cost $4\frac{1}{2}$d., what is the price of $1\frac{1}{2}$ lb.? of $3\frac{1}{2}$ lb.? of $5\frac{1}{4}$ lb.? of $6\frac{1}{2}$ lb.?

(9) If $4\frac{1}{2}$ lb. of tea cost 8s. 3d., what is the price of $2\frac{1}{2}$ lb.? of $5\frac{1}{2}$ lb.? of $6\frac{1}{4}$ lb.?

(10) If a homer pigeon flies 30 miles in 40 min., how long will it take to go 55 miles?

(11) Books are bought at the rate of 12 for 10s. 0d. What will it cost to supply a class of 39 girls with a book each?

(12) If 5 spades cost 11s. 3d., how much must be spent to buy 21 spades?

(13) If 10 gallons of wine cost £11, 5s., how much is paid for a cask containing 54 gallons?

(14) A man charges £1 for mowing 3 acres. How much will a farmer have to pay for 42 acres?

(15) I paid 10s. 0d. for 3600 cubic ft. of gas. My neighbour burnt 4800 cubic ft. How much would he have to pay?

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(16) A room is 18 ft. long and 15 ft. wide. All round it there is a border 3 ft. wide covered with oilcloth. What is the cost of this at 2s. 9d. per sq. yd.?

(17) A cart-wheel is 4 ft. 8 in. in diameter. What is the length of the iron rim which binds it together?

(18) Make up a sum about buying groceries for Christmas.

(1) A room is **27** ft. **9** in. long and **16** ft. **6** in. wide. What does it cost to cover it with carpet at **6**s. **8**d. per sq. yd.?

(2) The playing area of a football ground is **120** yd. long and **80** yd. wide. All round this is a cinder-track **6** ft. wide. What is the area of the track?

(3) A man left $\frac{3}{8}$ of his property to his widow, and the rest to be divided equally among his **4** sons. What part did each son get?

(4) What is the simple interest on £**375** for **3** yr. at **4** per cent. per annum?

(5) A man bought **2** cwt. of sugar at $2\frac{1}{4}$d. per lb., and sold it at the rate of **4** lb. for $10\frac{1}{2}$d. What profit did he make?

(6) **500** eggs will just fill **3** baskets. Two of them are the same size; the other holds **3** times as many as either of them. How many eggs are there in each basket?

(7) The frontage of each of **10** houses is **18** feet. There is a causeway **6** ft. wide in front of them. What is the area of the causeway?

(8) On 1st Jan. 1912 a man put £**80** in the Post Office Savings Bank at $2\frac{1}{2}$ per cent. He withdrew the whole on 1st Jan. 1913. How much did he get?

(9) A house is rented at £**30** per year, and the rates are paid on $\frac{4}{5}$ of this amount. If the rates are **8**s. **6**d. in the £, what is paid for rent and rates?

(10) **1** Kg. = **2·2** lb. How many Kg. are there in **2** tons of hay?

(11) How many cubic ft. of air are there in a room **25** ft. long, **18** ft. wide, and **14** feet high?

(12) How often can **7·2** dm. of string be cut from **144·72** metres?

(13) A class made **360** attendances out of **400**. What percentage was this?

(14) Simplify: (*a*) $(2\frac{3}{4}-1\frac{5}{12})\div(1\frac{3}{8}-\frac{5}{6})$;
(*b*) $(2{\cdot}35\times1{\cdot}5)+({\cdot}125\div{\cdot}05)$.

(15) What does it cost to pave a street **27** ft. long and **15** feet wide at **12**s. **6**d. per sq. yd.?

(16) A cow cost **1**s. **9**d. per day to keep, and milk is $3\frac{1}{2}$d. per quart. Make up a sum, using these two facts.

(17) Find the wage-bill for **829** men, if each earns £**1**, **9**s. **8**d.

Exercise 66.—Miscellaneous Exercises—II.

(1) Make out a bill for the following: **36** chickens, a week old, at **8**d. each; **25** hens at **3**s. **9**d. each; **21** ducks, **2** months old, at **1**s. **10**d. each; **10** chickens, weighing **35** lb., at **9**d. per lb.; **200** eggs at **8** for **1**s.

(2) In front of a house there is a lawn **24** ft. long and **15** ft. wide. All round is a path **4** feet wide. What is the area (in sq. feet) of lawn and path together?

(3) A man owns $\frac{3}{5}$ of a mill. He sells $\frac{1}{4}$ of his share, and gives half of what he has left to his son. What part does the son get?

(4) Find the value of the following:

$$£3{\cdot}65 + £1{\cdot}45 - £{\cdot}35 - £1{\cdot}05.$$

(5) **56·4** Kg. of butter cost **2·85** francs per Kg. What is the value of the butter?

(6) Find the value of **5** tons **16** cwt. of lead, at £**21**, **10**s. per ton. (*Work this by both decimals and vulgar fractions.*)

(7) Twelve shop windows, each **12** feet square, are to be refitted with plate-glass. What will be the cost at **18**s. **0**d. per sq. yd.?

(8) A room **30** ft. wide and **18** feet high is divided into three by two partitions. If the boards cost **1**s. **2**d. per sq. yd., what will be the cost of the wood?

(9) Turnip-seed is sown at the rate of $\frac{7}{8}$ oz. for **10** sq. yd. How many lb. will be needed to sow a field **60** yd. long and **44** yd. wide?

(10) $\frac{9}{10}$ of the weight of a cabbage is water. What weight of water is there in $2\frac{1}{2}$ tons of cabbages?

(11) In three weeks a mill uses **42** tons of coal. How much will be used in **30** weeks?

(12) A picture is $12\frac{5}{8}$ in. long and $8\frac{2}{3}$ in. wide. What is the difference between the sum of the two lengths and the sum of the two breadths?

(13) Work the following:

(*a*) $3x + 18 = 27$; (*b*) $2x - 6 = \frac{x}{2} + 4$;

(*c*) $\frac{4}{x} - 3 = 5$; (*d*) $x + \frac{2}{3} = 2x + \frac{1}{3}$.

(14) A school plot is **12** yd. long and **5** yd. wide. In trenching, the ground is dug **2** ft. deep. How many cubic yd. of earth are turned over?

Exercise 67.—Common-sense Tests.

(1) A train goes at the rate of **40** miles per hour. How many telegraph-posts **60** yd. apart will the train pass in **15** min.?

(2) A father is **4** times as old as his son. Their ages together are **65** years. How old is the father?

(3) The cash-register at a grocer's shop stands at £**2**, **16**s. **4**d. for the goods bought by a woman. She had bought **8** stones of flour at **1**s. **8**d. per stone, **24** lb. of bacon at **11**d. per lb., and a ham weighing **21** lb. How much per lb. was the ham?

(4) Sugar is bought at $2\frac{1}{4}$d. per lb. What is gained by selling **2** cwt. for £**2**, **17**s. **4**d.?

(5) A litre equals **1·75** pints. If a wine merchant bought **80** litres of port wine, how many pint-bottles could he fill?

(6) An oil merchant bought **36** gallons of oil at **3**s. **4**d. per gallon, and mixed it with **24** gallons of oil at **1**s. **8**d. per gallon. He sold the whole for £**13**, **10**s. What profit did he make?

(7) A man buys **100** turkeys, weighing on an average **14** lb. each, at **9**d. per lb. He sells the whole at an average price of **1**s. **0**$\frac{1}{2}$d. per lb. How much does he gain if he paid £**3**, **12**s. **0**d. for carriage?

(8) A circular race-track is $\frac{1}{4}$ mile round. How far is it from the edge to the centre?

(9) A map is made to the scale of **6** inches to the mile. What area will a map represent which is **4** feet long and **3** ft. **6** in. wide?

(10) A boy had to weigh **50** parcels of equal weight. He put down the weight of each as **1·35** Kg. instead of **1·53** Kg. How much was he wrong in all?

(11) On an average a woman used one bag of coal each week during the year. Each bag weighed **1** cwt. and cost **1**s. **1**d. If the coal could be bought at **18**s. **9**d. per ton, what was lost by buying bags?

(12) A man is now **65** years of age. **25** years ago he was twice as old as his son. What is the present age of his son?

(13) Show the difference between a linear yard, a square yard, and a cubic yard.

(14) Make up a sum about any wagon which passes near the school.

Exercise 68.—Speed Tests.

(The number of minutes allowed for each item is shown in brackets.)

(1) Add the following downwards, and then across:

	(*a*) (4 m.) £ s. d.	(*b*) (4 m.) £ s. d.	(*c*) (4 m.) £ s. d.	(*d*) (4 m.) £ s. d.	
1.	39 19 $8\frac{1}{2}$	189 14 $9\frac{1}{2}$	297 16 $8\frac{3}{4}$	894 14 $11\frac{1}{4}$	(2 m.)
2.	134 16 $4\frac{3}{4}$	3914 16 $4\frac{3}{4}$	1298 16 $4\frac{3}{4}$	1148 15 $3\frac{1}{2}$	(2 m.)
3.	1281 18 $11\frac{1}{2}$	2210 15 $9\frac{1}{2}$	249 5 $9\frac{1}{4}$	298 17 $8\frac{1}{4}$	(2 m.)
4.	879 9 $8\frac{3}{4}$	987 19 $8\frac{1}{4}$	371 18 $7\frac{1}{2}$	344 18 $3\frac{3}{4}$	(2 m.)
5.	1672 12 $6\frac{1}{2}$	3721 13 $3\frac{3}{4}$	2814 14 $6\frac{3}{4}$	1247 15 $6\frac{1}{2}$	(2 m.)
6.	7036 14 $7\frac{3}{4}$	8729 15 $8\frac{1}{4}$	9017 13 $8\frac{1}{2}$	8076 12 $8\frac{3}{4}$	(2 m.)
7.	8907 8 $11\frac{1}{2}$	3097 17 $4\frac{3}{4}$	6309 18 $10\frac{3}{4}$	2618 13 $9\frac{1}{4}$	(2 m.)
8.	294 13 $10\frac{3}{4}$	896 16 $10\frac{1}{2}$	972 14 $11\frac{1}{2}$	809 14 $11\frac{1}{2}$	(2 m.)
9.	389 19 $11\frac{1}{2}$	1037 17 8	1087 15 10	1887 15 4	(2 m.)
10.	1008 14 $8\frac{3}{4}$	1994 15 $6\frac{1}{2}$	1992 3 $11\frac{1}{2}$	1007 6 $3\frac{1}{4}$	(2 m.)

(2) **16297 × 47; 279; 248; 387.** (10 m.)

(3) **46387 ÷ 37; 127; 39; 48.** (10 m.)

(4) **£74, 18s. 9½d. × 49; 94; 240; 397.** (20 m.)

(5) **£7359, 14s. 10d. ÷ 37; 79; 267; 148.** (20 m.)

(6) **13 tons 15 cwt. 1 qr. 8 lb. × 19; 48; 121; 65.** (20 m.)

(7) **12 miles 7 fur. 5 ch. 10 yd. ÷ 19; 57; 68; 139.** (20 m.)

(8) (*a*) $1\frac{1}{4}+2\frac{5}{8}+3\frac{1}{5}+1\frac{7}{10}$; (*b*) $2\frac{1}{3}+1\frac{3}{5}+2\frac{1}{6}+1\frac{3}{10}$. (6 m.)

(9) (*a*) $(5\frac{1}{4}-1\frac{4}{5})-(1\frac{1}{2}+1\frac{2}{3})$; (*b*) $(4\frac{2}{5}-1\frac{1}{6})-(2\frac{1}{3}-\frac{1}{5})$. (6 m.)

(10) (*a*) $\frac{3}{7}\times1\frac{5}{9}\times1\frac{2}{3}$; (*b*) $3\frac{1}{3}\times1\frac{1}{5}\times3\frac{3}{4}$. (6 m.)

(11) (*a*) $(3\frac{3}{4}\times1\frac{1}{5})\div(2\frac{1}{3}\times1\frac{5}{7})$; (*b*) $(2\frac{3}{4}\times1\frac{1}{11})\div(2\frac{1}{6}\times1\frac{1}{13})$. (6 m.)

(12) (*a*) **31·47 × 12·8**; (*b*) **26·48 × 11·7**; (*c*) **16·59 × 24·3**. (10 m.)

(13) (*a*) **23·6 ÷ 5·7**; (*b*) **63·47 ÷ 1·9**; (*c*) **921·4 ÷ ·37**. (10 m.)

(14) Express as decimals: $1\frac{3}{5}$; $2\frac{4}{25}$; $1\frac{9}{10}$; $3\frac{7}{50}$; $2\frac{3}{8}$. (4 m.)

(15) Express as fractions: **6·25; ·35; 1·075; 3·225; 1·625.** (4 m.)

(16) Find the value of: (*a*) **·25** of **2** guineas + **1·325** of **£1** + **6·75** of **10s. 0d.**; (*b*) **·875** of **2** tons + **1·375** of **1·5** tons + **2·25** of **2** cwt. (6 m.)

(17) What is (*a*) **5** per cent. of **760** men? (*b*) **4** per cent. of **£750**? (*c*) **7** per cent. of **400** boys? (2 m.)

(18) What is the value of (*a*) **647** articles at **£2, 17s. 9d.** each? (*b*) **255** cwt. of lead at **15s. 8d.** per cwt.? (8 m.)

(19) Find the average of: (*a*) **37** lb., **28** lb., **33** lb., **19** lb., **48** lb., **39** lb.; (*b*) **24·6** Kg., **28·4** Kg., **18·5** Kg., **37·6** Kg., **47·8** Kg., **27·9** Kg. (6 m.)

Exercise 69.—Examination Tests.

A.

(1) (*a*) On a piece of square paper show the value of ·35.
(*b*) If you had a piece of paper 10 in. long and 7 in. wide, on what scale would you show a room 21 ft. long and 16 ft. wide?
(*c*) Draw a rhombus with sides 3 in. long and one angle 60°.
(*d*) Show how to calculate the cost of 360 lb. of rice at 5d. per lb.

(2) A train travelled 241·4 miles in 6·6 hr. Find to tenths of a mile the rate per hour.

(3) Work the following grocer's bill: 56 lb. of currants at 6½d. per lb.; 66 lb. of raisins at 7½d. per lb.; 83 lb. of rice at 4½d. per lb.; 76 lb. of bacon at 10d. per lb.

(4) Twelve books cost 17s. 6d. What is the price of 44 books of the same kind?

(5) The rent of a house is £45 per year. Rates are charged on $\frac{4}{5}$ of the rent. If the rates are 8s. 4d. in the £, what is paid per year in rent and rates?

(6) A plot of ground in a park is 50 yd. long and 30 yd. wide. All round this plot is a belt of shrubs 6 ft. wide. What area is covered with shrubs?

B.

(1) (*a*) Show by a drawing that $\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$.
(*b*) Draw an equilateral triangle with sides 3 in. long, and show how to find the area.
(*c*) Make a drawing of the end of a house, and put in the dimensions.
(*d*) Explain how to write £1, 16s. 6d. as a decimal.

(2) After spending $\frac{2}{3}$ of my money, I find that $\frac{1}{4}$ of what is left equals 10s. 0d. How much had I at first?

(3) A bale of raw wool is 3 ft. 6 in. long and 2 ft. square. How many cubic yd. will 200 bales take up?

(4) What is the value of 785 bags of sugar at £1, 17s. 9d. per bag?

(5) What is the simple interest on £360 for 4 yr. at 4 per cent. per annum?

(6) Work the following by a graph: If 12 horses are allowed 48 lb. of oats per day, what should be allowed for 30 horses? for 4 horses? for 18 horses?

C.

(1) (*a*) Write down the value of the fours in the following: ·004 m.; 1·44 m.; ·4 m.; 400·2 m.
(*b*) Explain what π means, and show how to find it.
(*c*) What is the quickest way to work the following?—'Find the cost of 100 cwt. of sugar at 17s. 6d. per cwt.'
(*d*) Write down what is needed to make a triangle, and then construct it.

(2) Work out the following bill, and settle it: 2 rolls of calico, each 56 yd. long, at $5\frac{1}{2}$d. per yd.; 36 yd. of flannelette at 8d. per yd.; 45 yd. of flannel at 1s. $1\frac{1}{2}$d. per yd.; 25 yd. of serge at 2s. $4\frac{1}{2}$d. per yd.

(3) There were 450 persons at a concert. 20 per cent. paid 1s. 0d. How much money did these people pay?

(4) Find the cost of making a concrete path ·074 Km. long and 1·5 m. wide at 9·5 francs per sq. m.

(5) The average height of 6 members of a football team is 5 ft. 10 in. Two of these are 6 ft. 2 in. each. What is the average height of the other four?

(6) If a horse eats $\frac{3}{7}$ of a cwt. of hay in a week, how long will $8\frac{4}{7}$ cwt. last?

D.

(1) (*a*) Construct a parallelogram, having one angle 75°.
(*b*) Sketch the front of a piano, and put on it the dimensions.
(*c*) A door is 7 ft. high and 3 ft. wide. Compare the height and the width.
(*d*) Draw the plan of a picture, and show how to find the area of the border.

(2) When a boy had lost $\frac{4}{7}$ of his marbles, he won 10. He then had 49. How many had he at first?

(3) Four loads of coal weighed the following: 1·4 tons, 1·3 tons, ·95 ton, and 1·15 tons. What was the average weight?

(4) Find the cost of 355 tons of lead at £17, 17s. 6d. per ton.

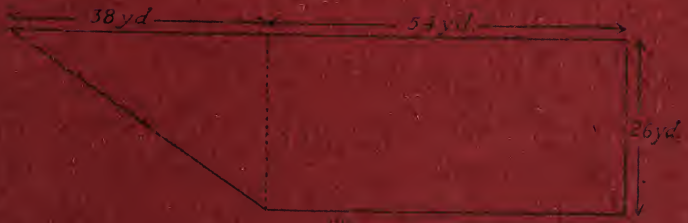
(5) A cubic yard of earth is a cart-load. How many cart-loads are taken out of a trench 25 yd. long, 9 ft. deep, and 6 yd. wide?

(6) A girl saved $\frac{1}{5}$ of her money in the bank. She spent $\frac{1}{2}$ of the remainder on a new coat. If she had 10s. 0d. left, how much had she at first?

DIAGRAMS TO ACCOMPANY EXERCISES 32 AND 45.

(1)

(2)



(3)